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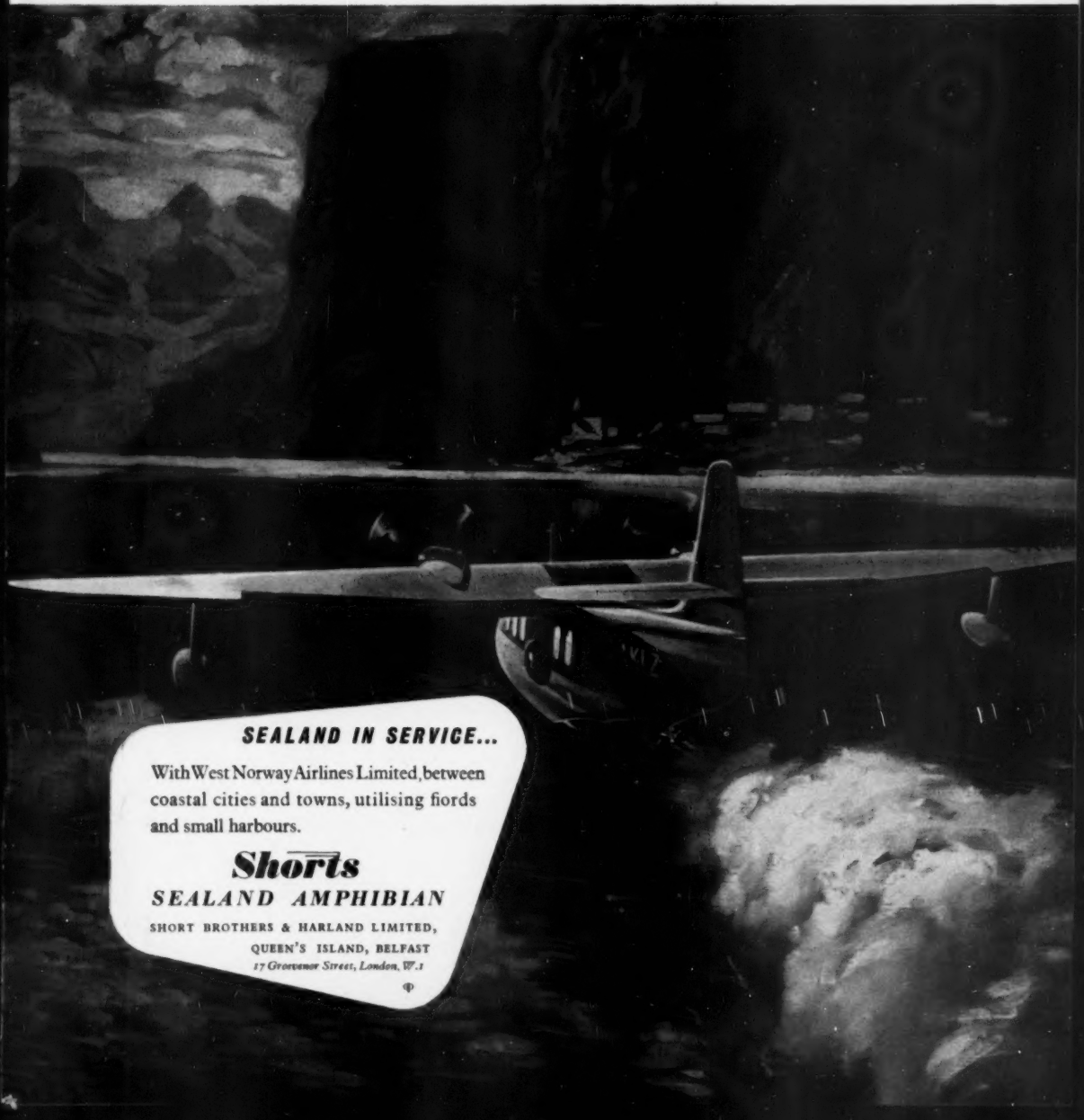

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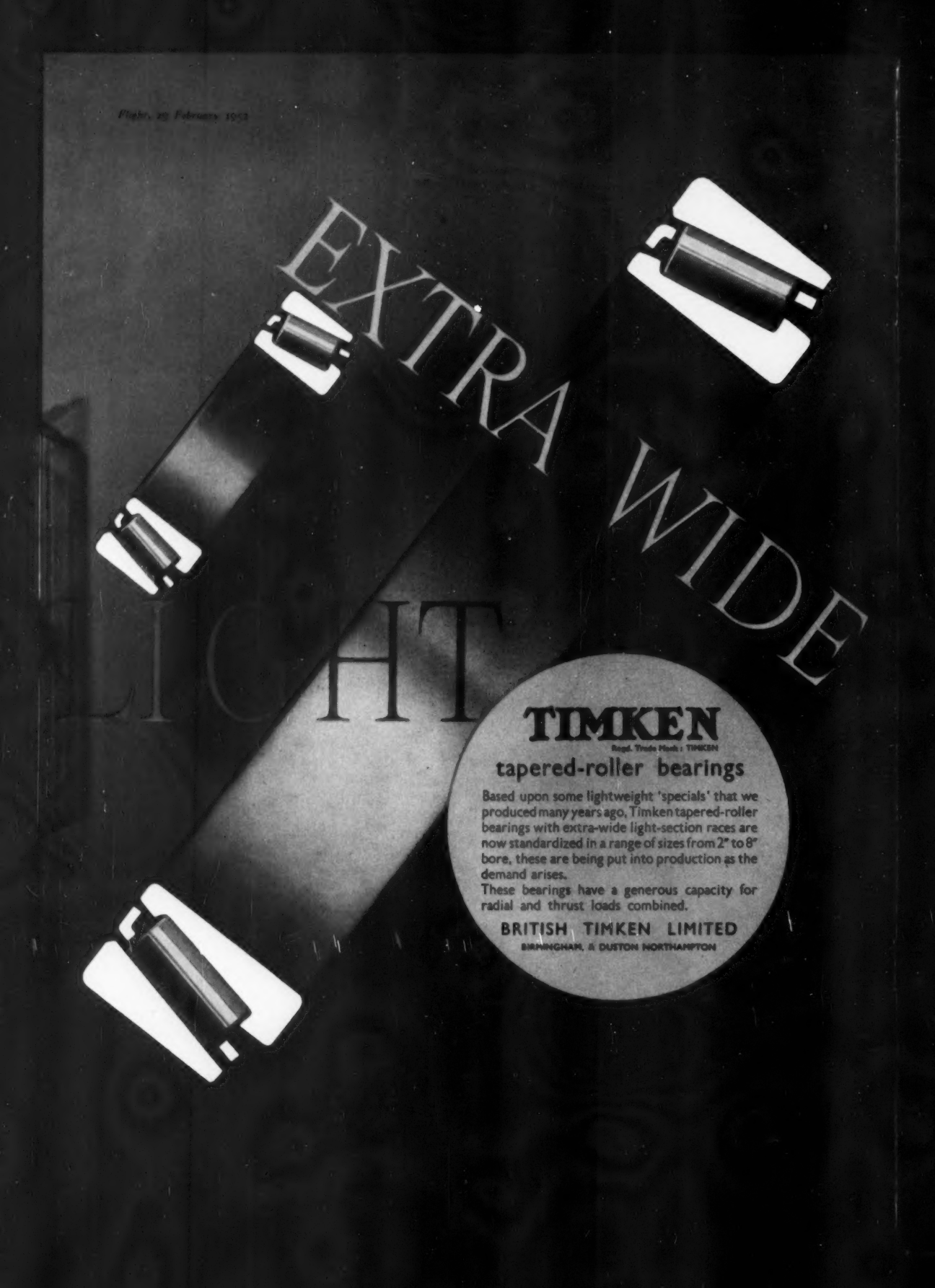
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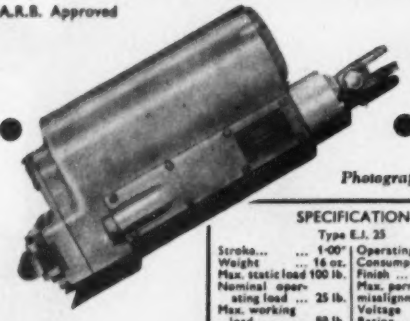

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A Crown for Each Head

FIVE shillings, or even seven shillings and sixpence, is not a very large sum of money, but even small amounts can cause quite a furore when a matter of principle is concerned—the shilling on prescriptions, for example.

So, from May 1st, air travellers arriving in this country will have to pay the Ministry of Transport and Civil Aviation for the privilege. The 5s (or 7s 6d for those from farther afield) is described as a standard charge for services, and does not take into consideration the quality of the facilities offered. If, coming from abroad, you descend from an airliner at a remote airfield, splash through mud to the gate, and thumb a ride to the nearest village, you, or the owners of the aircraft which delivered you, must still pay the fixed price for the privilege.

Few will quarrel with the intention, which is to help balance the State airfield budget; practically everyone will object to the method—namely, a head tax on arrival, levied through the operating companies so that the Ministry can forget all about the administrative problems involved. The idea, we are informed, was sprung on the operators one evening without notice or consultation in a manner more fitted to masters than to servants of the public, and at a time when the Corporations are doing everything possible to reduce deficits and fares, and the independent operators to improve their services and keep solvent.

The Ministry refer to this head tax as a service charge for provision of a passenger lounge, Customs hall, cloakrooms, and porters—not to mention first aid if needed. They are responsible for passengers, they say, from apron to coach, or the reverse. Prior consultation with the operators would have brought to light several points. For example, the advantages of imposing a departure tax rather than one on arrival. Will a man be interned or sent back home if he is unwilling to pay, or has no money? Again, if he has come to Britain by stages, has he come from the last port of call or from his original point of take-off? This is a half-dollar question, and neither ticket nor passenger list necessarily gives the information.

The administrative problems may be considerable, and they should have been discussed in advance. Tax cannot be added to fares without I.A.T.A. approval (in May) for introduction in October. Are children to be charged in proportion to their fares, i.e. 50 per cent, or 10 per cent for babies in arms? What of airline staff flying on leave or duty?

If a departure tax had been preferred, matters might have been simplified; the 5s could be collected when the fare was paid and, say, a stamp affixed to the ticket (the Stamp Act permitting). Unfortunately such administrative matters must bear heavily upon the Corporations, not only in connection with their own passengers but in regard to those of foreign operators for whom they must now act as agents *and* tax collectors. Unfortunately the Corporations are not in a position to express their real feelings about this tax. Probably, though, something will be heard at Westminster from the Opposition—who thought of a head tax of this sort too, but failed to get it past Lord Pakenham.

The day the tax is due to come into operation is also the day on which cheap-fare "air-coach" services are due to start. What of these passengers? In theory at least, they carry their own bags and provide their own transport to and from the aircraft. All they must do is satisfy the Customs and immigration authorities. These are not services to be paid for, and no other buildings need be entered.

It is, of course, the short-haul operators who have most reason to complain of the tax—B.E.A. with their high-frequency services to Paris, and Silver City with their Channel ferry for example. Already they, like others, pay rent for all exclusive facilities at State airports and unusually big landing fees for their aircraft—not to mention high fuel-taxes.

Although landing taxes are levied under one guise or another in certain other countries—e.g. America, Bermuda, Jamaica, Portugal, French Equatorial Africa, and, until recently, Egypt—it seems a pity that we had to start this sort of thing here. It is true that surface transport has been paying some form of head tax, together with other dues, for years past, but over a period of time the detail sums have been absorbed. The picture so far as the aviation landing tax is concerned is as yet incomplete, but we are not very impressed by the introduction or implications to date.

DEFENCE in DARKNESS

IT was with real satisfaction that we beheld last week the first jet night- and all-weather fighter squadrons of the R.A.F. flying their Vampire N.F.10s and Meteor N.F.11s as to the manner born, though the crews have only recently converted from piston-engined Mosquito N.F.36s. The units concerned are part of a rejuvenated and expanded force now being established in Fighter Command and are appropriately based at West Malling, near Maidstone, Kent, which station has for many years been particularly associated with night fighting—as, indeed, have the squadrons themselves.

The station commander (who was being visited, on the occasion of our call, by A.V-M. the Earl of Bandon, A.O.C. No. 11 Group) is G/C. H. S. Darley, D.S.O., and the wing commander flying is W/C. A. P. Dottridge, D.F.C. The Vampire squadron is commanded by S/L. D. C. Furse, D.F.C., and has a history dating back to 1915. It was one of the first night-fighter squadrons to use radar-equipped Blenheims, and later—operating Beaufighters and Mosquitoes—its duties were extended to include intruder operations. Its Mosquitoes were in action against the flying bombs in 1944.

Commanded by S/L. J. D. Hawkins, A.F.C., the Meteor unit was also formed during the 1914 war. In the late war it had a variety of duties—day fighting in the Battle of Britain, night fighting, intruding, and daylight offensive patrol among them. In succession to Hurricanes it received Defiants, Havocs and Mosquitoes.

Although a detailed study of the equipment and performance of the Vampire N.F.10 appeared in *Flight* of February 15th, 1952, corresponding data for the Meteor N.F.11 are withheld. Readers may divert themselves, however, by estimating performance on the basis of published data for the Meteor T.7 trainer, upon which the night fighter design was founded, making allowance, of course, for the greater load represented by four 20 mm guns, radar equipment and other aids. What can be said with certainty is that the rate of roll and other aspects of handling have been noticeably improved by the fitting of spring-tab ailerons. The guns are electrically fired and are mounted outboard of the nacelles. Though a prototype appeared at the S.B.A.C. Display last year with wing-tip tanks, the Meteors at West Malling retain the original, less efficient, under-wing tanks, which they usually carry in addition to the ventral fuselage tank.

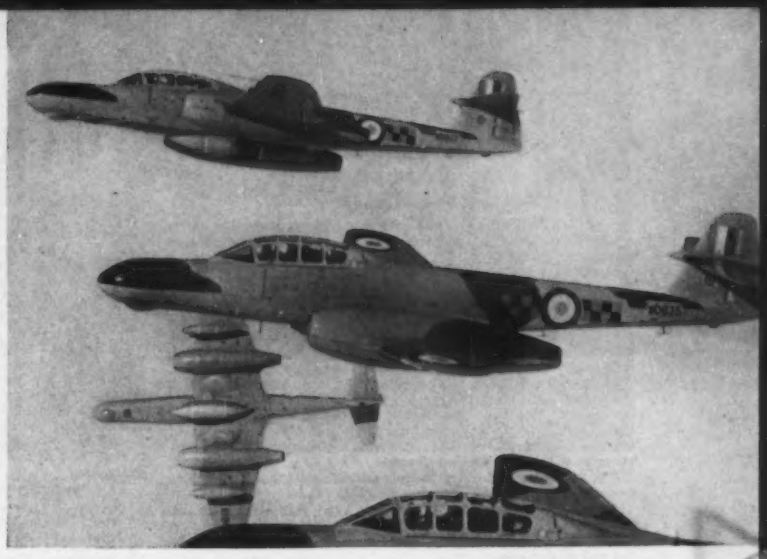
In their squadron markings (red and black dicing) and grey and olive camouflage, the long, narrow Meteors looked as though they really meant business. One noted the landing lights in each leading edge, the camera gun inboard of the starboard nacelle, and ballast stowage in the nose, presumably for use when radar is not installed. The Vampires were in process of receiving their squadron badges, and their generally trim appearance was not enhanced by large red inscriptions warning of live ammunition in the "cans." Neither they nor the Meteors have ejection seats.

Regrettably, little can be said of operational techniques. Though these are basically similar to those in use during the war (i.e. the fighters are guided to the vicinity of their

There is a fine spirit of rivalry at West Malling between the crews of the squadron equipped with Vampire N.F.10s, four of which are seen above, and those who fly the Meteor N.F.11s (right).

D.H. Vampire N.F.10s and A.W. Meteor N.F.11s now Operating at West Malling

"FLIGHT" PHOTOGRAPHS



(Left) The Goblin turbojet of a de Havilland Vampire N.F.10 shatters the stillness of the night with its fiery blast and piercing scream. (Right) Meteor N.F.11s at the moment of peeling-off from close formation on a Ministry of Supply photographic Lancaster.

targets by G.C.I. and in the final stages are assisted by A.I.), certain modifications have been necessitated by the higher speeds involved.

An official Air Ministry statement points out that the Vampire and Meteor night fighters are capable of intercepting enemy aircraft farther from our coasts than their predecessors, and, thus, of achieving a higher percentage of successful interceptions before the raiders can reach their targets. As the turbojets need no preliminary warm-up and allow a simpler cockpit drill, "scramble" times have been much reduced and turn-round time between sorties has been shortened due to the easier maintenance involved. We ourselves saw Meteors and Vampires getting away in elapsed times of 1 min 15 sec to 1 min 30 sec from the moment the pilot (who was already seated in the cockpit) started the power plant to the instant the wheels unstuck. On these occasions the aircraft were parked on a concrete apron near the end of the runway.

Up to the present conversion training on to the jet night fighters has been largely undertaken on the operational stations concerned. Former Mosquito pilots are given a few hours on Meteor 7s, though some of the less experienced among them have taken a full jet-conversion course at a training unit. Special operational conversion units for the Vampire N.F.10 and Meteor N.F.11 will be opened this year.

In the flying control tower we heard "Eyewash" (the G.C.I. station) vector a Vampire ("Quagmire 38") on to a Meteor "bomber." Eyewash advised the intercepting pilot that his target was at "one o'clock warm," then "one o'clock hot," and suddenly the voice of Quagmire 38 came back "Contact," and after a decent pause, "Interception completed." On a later sortie we listened to Quadmire 31 being controlled down from angels 20 ("Begin your let-down . . . turning height angels 13 . . . transmit again at 16"); heard him brought into the safety lane; and finally handed over to G.C.A. for talk-down ("In line with the runway . . . three miles to go . . . heading 265 . . . on glide path . . . check wheels and flaps . . . left 30 . . . heading good . . . little bit high . . . adjust rate of descent")—and finally the Vampire came whistling in over the hedge before our eyes.

From the same vantage point, after dark, we watched a Meteor, its presence proclaimed only by its navigation lights, streak off the runway and go thundering into the blackness. Then ("Scramble one Vampire!") a distant brewing up, and once again red, green and white navigation lights scurrying past with, in this instance, a dull glow from the Goblin's tailpipe.

One left West Malling later (considerably later) that evening confirmed in the impression that the squadrons are happy in their work and happy with their aircraft, though no one would pretend that substantial improvements in performance, endurance and armament are not already desirable. The next night- and all-weather fighter scheduled for R.A.F. service is, of course, the Ghost-powered de Havilland Venom N.F.2; but even this will fall far short of the standard established by the D.H.110 (two Rolls-Royce Avons) and Gloster G.A.5 (two Armstrong Siddeley Sapphires), the first flights of which took place last year. Prototypes of both are still undergoing makers' trials, however, and none of either type could be in service in under two or three years. Meantime, any B-29-type piston-engined bomber approaching our coast with fell intent can count on a warm reception from the West Malling squadrons and others now equipping with the "N.F." Vampires and Meteors—forerunners of the 110 and G.A.5., themselves the world's most formidable night-and-all-weather fighters.

A new shape in the R.A.F. is the pencil-nosed Armstrong Whitworth Meteor N.F.11 (two Rolls-Royce Derwents), a group of which is seen, resplendent in squadron markings.

FROM ALL QUARTERS

Western Europe's Airfields

A HIGH-PRIORITY programme of airfield construction in the SHAPE area was agreed upon at last week's NATO military committee meeting in Lisbon, following the presentation of General Eisenhower's critical report by his Chief of Staff, Gen. Gruenther.

In forwarding the report to the NATO Council, the committee recommended that a decision should be reached on the sharing of costs. Countries where airfields were to be located should be requested immediately after the Lisbon meeting to acquire the land to take advantage of good building weather now approaching.

Gen. Gruenther had presented the airfield construction plan to the committee during the previous week, but had been requested to take it back to SHAPE and have it cut drastically. The revised version—still to cost "several hundred million dollars"—Gen. Eisenhower considered to be the absolute minimum to ensure the effective defence of Western Europe.

"Austerity" and "utility without trimmings" would, said Gen. Gruenther, characterize the new airfields.

News of the airfields decision preceded the announcement, made at the week-end, that the Lisbon Conference had agreed on a target figure of 4,000 operational aircraft for Western Europe by the end of this year.

The First Princess

RECENT visitors to the mouth of the River Medina, in the Isle of Wight, will know that the first Saunders-Roe Princess flying-boat is in launching position with both outer sections of the wing—each 53ft in span—fitted and with the floats retracted at the wing-tips. Awnings have been erected over the engine bays so that work may continue in weather fair or foul; beneath them steam heating and strip lighting afford physical comfort and illumination.

Inside the Princess, instruments, equipment and a great mass of multi-coloured wiring are being installed, and here the air is warmed by a number of domestic radiators on both decks. Securely picketed to the apron, the big flying-boat defied the gales which earlier this year broke up the sea front at Ryde and demolished the pier at Seaview.

Jet-patent Petition

IN the Chancery Division last week, A. Cdre. Sir Frank Whittle gave evidence on a petition by himself and by Power Jets (Research and Development), Ltd., for the extension of a 1936 patent due to expire on March 3rd. The patent concerns the by-pass type of gas turbine.

Counsel for the petitioners said that owing to the war and to the long time it took to develop jet engines the invention had never been exploited commercially.

In his own evidence, A. Cdre. Whittle briefly outlined the history of his invention of the jet engine, from the time when he first conceived the idea in 1929 until the Government acquired an interest in Power Jets, Ltd., in 1944.

The invention which was the subject of the present suit was a much more flexible engine than the straight turbojet. The fuel consumption in proportion to power was very much better.

Sir Frank added: "The invention described in this patent is the most important form of aircraft gas turbine that I know of."

It was the best form of engine for any fast, long-range aircraft and combined with afterburning, it might be the best form of engine for supersonic flight.

On the second day of the hearing, Mr. Justice Lloyd-Jacob gave permission for certain evidence to be heard in camera.

Earlier on this day, Counsel for the Board of Trade asked "if the climate after the war" would have permitted the exploration of new fields. Sir Frank replied that this would have been true if Power Jets, Ltd., had been allowed to direct their own policy. When the Government-owned company was formed in 1944 Sir Stafford Cripps gave a directive laying down its functions, ostensibly permitting the making of new engine projects. He also appointed a technical advisory committee, on which were represented prominent members of the aircraft industry.

The committee argued, continued Sir Frank, that if the Government company was allowed to make new designs it would break an undertaking in the House of Lords not to compete with industry. Owing to pressure from the aircraft industry and disagreement about the company's new terms of reference, the decision was taken to convert the plant into the National Gas-Turbine Establishment.

Mr. Justice Lloyd-Jacob: "How did it come about that with the great advantages that this invention had, no one from 1946 onwards did the least thing about it?"

Sir Frank: "I wish I could answer that. I have continuously urged both in writing and verbally that this type of engine should be got on with but nothing has been done."

On February 26th, Mr. Justice Lloyd-Jacob granted the petition extending for ten years the life of the letters patent.

Bristols to Service Sabres

THE following statement was issued last week by the Bristol Aeroplane Co., Ltd.: "Further evidence of the increasing extent of the Bristol Aeroplane Company's interests in Canadian business is provided by the announcement that the Company is, by arrangement with Canadair, Ltd., of Montreal, also undertaking responsibility for the repair and overhaul of Royal Canadian Air Force Sabre F-86 fighters based in the United Kingdom. It will be remembered that the Company recently announced the formation of a Canadian subsidiary, and that the R.C.A.F. has during the past few months taken delivery of a number of Bristol Freighters."

This announcement follows the news, which we recorded last week, that Airwork, Ltd., have been appointed sub-contractors for the overhaul, repair and maintenance of R.C.A.F. Sabres in Britain.

Centaurus Freighter to be Built

WE record with pleasure that at long last Blackburn and General Aircraft, Ltd., are able to announce that an order has been received from the Ministry of Supply for the completion of the Mark 2 Universal Freighter, work on which was suspended some time ago as a result of a change in Service requirements. The Mk 2 medium-range heavy transport will be basically similar to the original prototype, which is now engaged on the final phases of its flight testing prior to trials involving the parachuting of vehicles and other heavy loads.

Some details and estimated performance figures for the Mk 2 were given in *Flight* of August 24th last, but since that time certain other changes have been incorporated in the design. The most important differences between the Mks 1 and 2 are that four Bristol Centaurus engines (probably 2,940 h.p. 1718, similar to the civil 6618 but with single-stage superchargers) will be fitted in place of the Hercules in the present machine, and an improved rear fuselage substituted to facilitate the handling of bulky cargo.

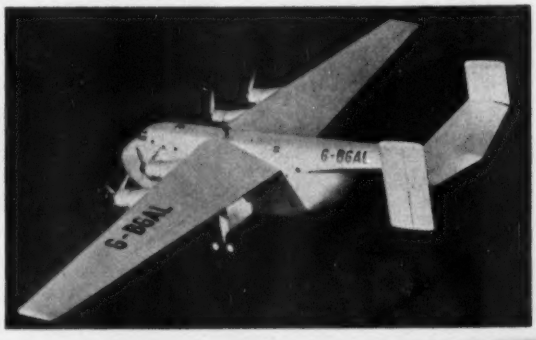
The Mk 2 will have a tubular tail boom above the freight compartment, clamshell-type loading doors and quickly removable ramps. The new tail boom is slightly upswept, with the result that the tail surfaces are a little higher than on the prototype. There is a small weight and drag reduction. The small doors, originally positioned in the fuselage side, are now placed in the clamshell doors. Rear fuselage skinning is to be thinner.

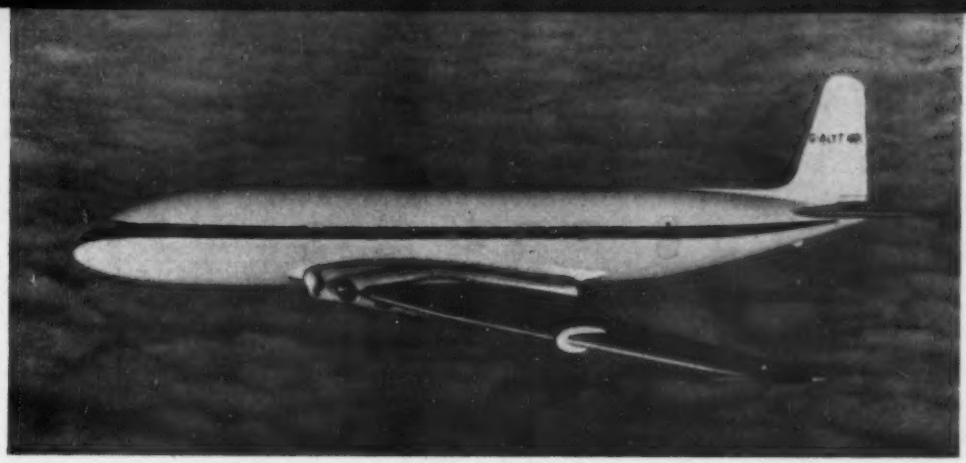
Another small but important alteration is the provision of an extra 4ft in the length of the main floor, resulting from a slight redesign at the front end.

Among details of interior arrangements which will differ in the Mk 2 may be mentioned the provision of a small passenger compartment on the flight deck behind the crew cabin. If a crew of only three is carried—and this is foreseen for a number of duties—this might be regarded as a V.I.P. or first-class compartment for five passengers. On the Mk 2, the crew will be provided with powered nosewheel steering, probably operated by a central tiller.

With the aid of some 3,500 additional horsepower the payload of the Mk 2 can be raised to 20 short tons with an a.u.w. of 127,000 lb, while retaining the unique take-off and landing characteristics. The maximum cruising speed will also be increased to 225 m.p.h. for civil or military operation, and the low operating costs will be particularly appreciated. To quote a representative example, the direct operating cost for the 1,000-mile stage, carrying 15½ short tons at a speed of 170 m.p.h. average, is

The Centaurus-powered Blackburn and General Aircraft Mk II Universal Freighter—seen here in the form of a convincing model.





STEPPED-UP COMET: Most noticeable difference in the Series II Comet—of which this is the first photograph—is seen in the size and shape of the intakes for the Avons, while there is also a rearrangement of the tail-pipes, the inboard pair being toed slightly outwards. The temporary colour-scheme includes a white top, with yellow corrosion-resisting undercoat beneath the waistline. The first flight took place on February 16th.

expected to be 10d per ton-mile (statute) over the whole flight.

According to the manufacturers, the Universal Freighter is the only aircraft that can land on a grass field 1,000 yd long, load 20 tons of freight, and fly out again. It is hoped that the Mk 2 will fly early in 1953.

More Polar Strategy

THE existence of another U.S. air base in the North Polar regions was revealed last week, when a Senate sub-committee was hearing evidence on airfield-construction costs.

Explaining to the committee the high wages paid to the construction workers—£80 a week for labourers and £120 for mechanics—Lt.-Gen. Pick, Chief of Army Engineers, said that to get good men to do the job fantastic wages had to be paid; this was "something new"—nobody had ever done it before.

The location of Thule on the Greenland coast.

Reports from Washington last week-end—at first of a speculative nature, but later more positive—named Thule as the place at which the airfield was situated. One report said that 10,000ft runways had already been completed and that "test landings by the largest U.S.A.F. bombers" had already taken place.

Thule is an Eskimo settlement far up the west coast of Greenland and opposite the extreme north-east of Canada, at latitude 75 deg. N. It is roughly equidistant, on direct air courses of 2,600 to 2,800 miles, from New York, London and Moscow.

The Thule coastline is normally approachable by sea in August, when the ice "breaks south." It is comparatively flat and the snowfall is barely 5in annually.

The weather can be excessively bad: fog, high winds, summer blizzards and winter temperatures of – 60 deg F (92 deg of frost). The direction of the prevailing winds, however, tends to keep at bay the consistently foul weather of the mighty Greenland Ice Cap, home of the "worst weather in the world."

Just how closely, if at all, this revelation ties up with the "floating airfields" project of which we published the first news last week, and with the journey of the three aircraft of operation "Ski Jump II" to Point Barrow, Alaska, remains to be seen.

The Swift Affair, or the Dutch Twins

MOST British readers will have noted with concern or mild delight (according to their temperament and their acquaintance with "security") the recent disclosure in the *Daily Express* that a description of the Supermarine Swift, with sectional drawings, had appeared in the Swiss journal *Interavia*. This material is a compilation by 23-year-old twins resident in Haarlem, and makes an interesting comparison with the large *Flight* copyright drawings of the Supermarine Attacker (May 15th, 1947) and Type 510 (March 2nd, 1950). It would appear, moreover, that the artist/authors—Mijnheeren Das—have paid us the somewhat dubious compliment of redrawing two sketches (of tanks and intake arrangements) appearing in the Attacker article.

True, certain information—correct, part correct or wholly inaccurate—has been disclosed which has not hitherto been published in the British Press; but this is just another instance of what British technical journals have long endured.

General Electric—de Havilland Agreement

A MANUFACTURING agreement of great importance, negotiated between the de Havilland Engine Co., Ltd., and the General Electric Company of America, was announced last week-end. Negotiations between the two companies have been going on for some time past and, with official approval, there is in future to be a full interchange of technical knowledge. Unlike the earlier licensing agreements for a given design or designs of engine, of which there have been many between British and foreign countries, this arrangement provides for interchange of knowledge and experience at all stages, from design, through testing and development, to maintenance and major overhaul.

It is understood that for a long time past there has been a friendly relationship between the two companies, and it is most gratifying that this should have culminated in the present agreement, which is not only of the greatest value to the participants but is to be regarded as another most important international transatlantic link. There follows the official statement agreed by the two companies. Some notes on their individual backgrounds in the aircraft gas-turbine field will appear next week.

"The de Havilland Engine Company, Ltd., of England and the General Electric Company of the United States of America, through its overseas affiliates, the International General Electric Company, jointly announce that they have signed an agreement for a full interchange of knowledge and experience, both current and future, in the field of gas turbines for aircraft, with the exception of aircraft nuclear propulsion. This agreement will bring together for mutual advantage the wealth of experience which the two companies have accumulated. . . .

"Both companies recognize that no one organization is nowadays able to cover, with the necessary intensity of specialization, every side of the entire development of the new form of power unit for aircraft, and the General Electric and de Havilland concerns have come to recognize over the post-war period that each has acquired special knowledge which is of great value to the other. Each company expects to benefit substantially from this exchange of knowledge without losing anything in the integrity and independence of its own projects.

"The agreement will be implemented by the visits of key technicians across the Atlantic . . . [it] has been approved by the United States Government and the British Ministry of Supply."

AIR DEFENCE

R.A.F. Equipment, Manpower and Costs Surveyed in White Paper

THE efforts now being made to strengthen the air defence of this country are among the subjects broadly surveyed in a Government White Paper, *Statement on Defence, 1952*, issued on February 21st. Expenditure estimated for the greatly expanded rearmament programme covering the three years, April, 1951-March, 1954, totalled £4,700,000,000. The air side of the programme was covered by the announced aim "to increase the front-line of the Air Force in all theatres, and in particular to expand the forces placed under the Supreme Allied Commander, Europe; to provide it with modern equipment; and to overhaul the radar network of the U.K."

On the subject of the financial costs involved, the White Paper tabulates figures (in £ millions) for 1951-52 against net estimates for 1952-53.

1951-52			1952-53	
Original	Supplementary	Total	Estimate	Revised
328.7	1.8	330.5	467.6	437.6

It is stated that aircraft will account for over 20 per cent of the production expenditure, and the programme is said to provide for many new aircraft of all types, both for the Royal Air Force and the Royal Navy. Mention is also made of arrangements for the supply of "a substantial number" of F-86 Sabres. Canada will build these aircraft, and the engines and equipment will be furnished by the U.S.A.

Recorded among principal items in the ammunition requirements are aircraft gun ammunition and rockets for the R.A.F., while in the naval programme work on the construction of five aircraft carriers is to be accelerated, as also is the modernization of existing vessels.

Emphasis is placed on the rearmament works programme in which the main features will be the development and expansion of existing airfields, the rehabilitation of other airfields built during the war and subsequently disused, the air defence system, and the provision of covered storage for equipment from the expanded production programme.

In addition there is "a very large" additional programme of works services required for the U.S. Third Air Force in the U.K. A large proportion of these services is carried out by the Air Ministry, although a substantial contribution in money, labour and materials is being made by America.

Discussing the manpower situation, the White Paper gives a comprehensive picture of Air Force recruitment.

Comparative figures of regular strengths, in thousands, are given as :—

Actual		*Estimate*	
1950	1951	1952	1953
114.7	139.4	173.6	213.0

The effective date in each case is April 1st.

It is noted that in the Royal Air Force the effect of the 1950 pay increases in combination with other improvements was to give a rate of Regular recruitment in 1951 between three and four times that prevailing in 1948 and 1949.

Comparative figures for Regulars (male) recruited were :—

1947	1948	1949	1950	1951
33,000	13,600	12,200	23,600	44,900

It is mentioned in this connection that the Royal Navy have obtained most of the recruits they need despite difficulties in certain categories, notably in aircrew.

Stating that there are to be five National Service registrations this year instead of four, the report says the R.A.F. will get 73,200 out of the 237,000 men expected to be enlisted through the extra call-up.

Against this gain there is to be a progressive release of Regulars retained beyond their normal term of service as the result of the Korean emergency, and it is planned that all such personnel will have been released by September, 1953.

A "slow response" to the Reserve and Auxiliary Forces is noted. About 39,000 men have enlisted following termination of National Service.

Referring to production, the report states that it has become increasingly clear that one of the major difficulties in carrying out the programme is to ensure the supply of the right kind of labour in the right places at the right time. The aircraft programme in particular, which includes several new production lines for jet engines, requires the building up of a large labour force. Before the programme started, the labour force in the aircraft industry was about 150,000; it is now 177,000, and a further 50,000 will be required by March, 1953.

A SURVEY by the AIR MINISTER

A FEW days after the Statement of Defence was published, the Secretary of State for Air, Lord De L'Isle and Dudley, discussed in the House of Commons a number of the White Paper facts when he introduced a Memorandum on the Air Estimates, 1952-3.

The Memorandum indicates that the programme for the R.A.F. in the coming financial year provides both for an increase in the front line, considerably larger than in 1951-2, and for preparations for further expansion. The R.A.F. will have first call on the national resources.

In Fighter Command, there have been further increases in strength. Nearly all the regular day intercepter squadrons now have the latest marks of Meteor. The R.Aux.A.F. squadrons all have jet aircraft. The re-equipment of night fighter squadrons with jet aircraft is almost complete.

In Bomber Command, the first Canberra squadrons have been formed and more will follow during 1952. The medium bomber force will still be made up of Washingtons and Lincolns but its strength has been increased by the formation of further squadrons of Washingtons.

Coastal Command has been strengthened, but further expansion is necessary if the Command is to perform its increasingly important role. New squadrons for maritime operations are therefore being formed with Shackletons, and with Neptunes supplied from the U.S.A. under the Mutual Security Act.

In Europe, the R.A.F. 2nd Tactical Air Force is a most important contribution to the resources of the Supreme Allied Commander. Our largest expansion is taking place in this Command; its increased front line strength will include squadrons equipped with Venom aircraft. The closest possible association of this force with the proposed European Air Force is foreseen.

To improve their state of readiness, over 7,000 reservists were called up in 1951 for 15 days' refresher training in the Control and Reporting System. Similar training will again take place this summer. Several hundred reservists were called up last year for three months' intensive flying training; and nearly 100 qualified instructors returned for a period of 18 months.

The activities of overseas Commands of the R.A.F. are discussed. Close co-operation with Commonwealth and Allied Air Forces has continued. The strength of the U.S.A.F. in this country has been increased by the addition of fighter squadrons, and fighter squadrons of the R.C.A.F. are also stationed here and are training with Fighter Command.

On the subject of personnel it is stated in the Memorandum that between April and October, 1951, the total strength of the R.A.F. rose from 238,000 to 262,000. Since October, the strength has risen more slowly : it is expected to reach 270,000 by April, 1952.

Whilst there is no overall manpower shortage in the R.A.F., there is a shortage of highly skilled men in certain trade groups. The new engagements up to the age of 55, introduced at the beginning of 1951, are helping to retain skilled and experienced men.

The number of National Service volunteers for aircrew has been up to expectations and, although these men can give very little full-time trained service, they will make a very important contribution to the Reserve.

Entries to regular aircrew service, particularly pilots and navigators, improved steadily throughout the year. The main reason

was the introduction, in June 1951, of a new four-year engagement.

An important change in the method of meeting requirements for junior officers has been made by the introduction of a new class of officer somewhat similar to the Branch Officers of the Royal Navy. Warrant Officers and Chief Technicians are being given an opportunity to obtain permanent commissions as Branch Officers, serving until age 55 with limited prospects of promotion, but on a wide range of ground duties suited to their experience in the ranks. They will receive special rates of pay and enchanced pensions.

To supplement the supply of directly entered University graduates to the Technical Branch, a new Technical Cadet Scheme will be inaugurated this year. Under this scheme young men with appropriate educational qualifications will be granted permanent commissions for technical employment after a course of training which includes a three-year honours degree course at a university.

During 1952, 1,062 apprentices joined the Service, 66 per cent more than in 1950. The intake of boy entrants in 1951 was 1,814, more than double the number in 1950.

Over 40 per cent of young men registering for National Service asked to serve in the R.A.F. In addition, between April and December, 1951, 2,486 national servicemen transferred to regular engagements.

Although women have new rates of pay and improved conditions of advancement, recruiting for the Women's Royal Air Force remains disappointing.

Of Auxiliary and Reserve Forces it is stated that three new transport squadrons and more Fighter Control and Radar Reporting Units are being added to the R.Aux.A.F. Eleven flights in the R.A.F. Volunteer Reserve were formed at Fighter Command control and reporting stations last year, and three will be formed during 1952. Three reserve flights have also been set up for Movements (Embarkation) duties.

A start has been made by certain University Air Squadrons in the provision of training for navigators and fighter controllers.

Under the heading of "Works" it is learned that high priority will continue to be given to the rehabilitation and extension of the radar chain. At home, some 4,500 married quarters are under construction and about 2,000 will have been completed during 1951-2.

During 1952, four new types of training aircraft will be introduced into squadrons: the Vampire T.11, the Canberra T.4, the Provost and the Balliol. In addition, re-equipment of certain schools with the Varsity for crew training will be completed. Set-backs in production are being experienced.

The analysis of upper-air charts and the forecasting of upper winds are being extended as a matter of routine to the great heights required for the operation of jet aircraft. The series of charts of the upper winds over the globe to a height of 40,000ft, published in 1950, is being revised, and a detailed investigation of upper wind and temperature to some 55,000ft in the region between Middle Europe and the Equator has been started.

WEATHER and JETS

Topical Problems Discussed at Royal Meteorological Society Symposium

ON Wednesday, February 20th, a meeting was held under the ægis of the Royal Meteorological Society, at which five papers dealing with diverse aspects of meteorology and the operation of jet aircraft were presented. Following the reading of the papers, the meeting was thrown open to discussion.

The first paper was read by A. Cdre. G. Silyn Roberts (Ministry of Supply), who said there were seven main factors which influenced aircraft design from the meteorological viewpoint. These were :—

(i) *Cloud and fog.*—These introduced serious problems in air-traffic control, and meant the carrying of a heavy fuel reserve.

(ii) *Turbulent air.*—At the higher altitudes, the problem of stalling arose. Gusts were of less importance in relation to fighters than they were to bombers, but in any case designing for gusts meant carrying extra weight.

(iii) *Jet stream.*—On this factor more information was wanted.

(iv) *Ice.*—An alleviating factor was the temperature rise resulting from kinetic heating; at 600 m.p.h. the rise was 36 deg C, and at 1,000 m.p.h. it was 100 deg C. The icing problem was also relieved somewhat by the high rate of climb and the greater proportion of flight time spent above the weather. It was likely that thermal de-icing would be satisfactory, but it all meant more power being taken from the engine. Icing of air intakes meant loss of thrust. The importance of forecasting needed re-emphasis.

(v) *Hail.*—Experience to date showed that turbojet aircraft were not as susceptible to damage by hail as would perhaps be expected. There was, however, a risk to axial-flow engines.

(vi) *Temperature.*—This had a bearing on the mass flow through the engine.

(vii) *Precipitation static.*—Considerable interference in radio reception could be caused by static, although it could be reduced by the use of suppressed aerials.

A. Cdre. Roberts concluded by saying that he thought turbulence the most important of the seven factors he had mentioned. He had been told by one expert that a black cu-nim cloud was a "reasonable hazard," a white one "dangerous," and a yellow one "fatal."

Captain A. M. A. Maiendie (Flight Captain, B.O.A.C. Comet Fleet) emphasized the need for accurate meteorological forecasts. In particular there had to be :—

(a) Good communications between the aircraft and point of destination. The communications should not be relayed by any intermediate means. Contact with the destination should be established as soon as possible after take-off.

(b) Accurate forecast of upper winds was needed.

(c) One hour before take-off it was necessary to know ground temperature—6ft above the runway for the Comet air intakes; pressure altitude; wind and humidity (to date, however, this last-named did not seem to have much effect). An accurate forecast ensured that there could be the correct balance between fuel and payload.

With the Comet, clouds had been experienced at over 40,000ft. Turbulence had also been registered from 0 to 2½ g (although this high reading might have been due to the position of the recorder in the aircraft). At this height ice crystals had formed on windscreens and had persisted for five minutes.

G/C. C. G. Lott (Fighter Command) said that from the Service viewpoint the attainment of the aim was the prime consideration, and the risk was secondary. The Service dealt in large numbers of aircraft, and there was always the risk of having rapidly to land a lot of fighters because of their limited endurance.

He thought there was nothing like the human eye for interception and identification; but this raised the question of trails above the tropopause, and the forecasting of conditions under which they would be formed. There was also a need for a scientific study of vision at high altitude. Forecasting of accurate winds and temperatures was important, for they both affected range, and aircraft would be operating to the limit of their range. Accurate wind forecasting was also necessary for indentification. The advent of the jet fighter meant a more exacting demand on the meteorological forecaster. The matter was aggravated in regard to bombers, as an abortive sortie was extremely expensive.

Mr. G. J. W. Oddie (Meteorological Office) said that in forecasting temperature an accuracy of 2 deg C for runway temperatures could be obtained. In the case of the Comet, however, a temperature forecast at a height of 6ft above the runway was required. In upper air temperatures, forecasts to an accuracy of plus or minus 5 deg C could be given. The best source of factual weather data were the aircraft themselves, but few flew higher than 25,000ft. As a result of the higher speed of jet aircraft, virtually twice as much weather was sampled in unit time, and it could therefore be argued that there should really be twice as many weather reports issued from the aircraft. The real problem, nevertheless, was to obtain adequate data and thereafter to know how to use the information to best advantage.

Mr. C. S. Durst (Meteorological Office) spoke on the methods of forecasting winds.

The meeting was then thrown open to discussion, in which the following points arose: the need for accurate forecasts at sea where aircraft carriers were concerned, and the small staff and space which were available in such cases. It was then emphasized that the United Kingdom had no responsibility for meteorological forecasting outside a certain area. The forecasts from the Atlantic area could be considered to be reasonably satisfactory.

It was stated that no one knew what caused clear air turbulence, although it could be forecast with some degree of accuracy. It seemed there was a real need for a practical investigation into meteorological problems. For example, jet engines should be flown through icing conditions—simulated conditions were not good enough. The problem of canopy icing was touched upon, and this was especially important in connection with Service aircraft.

A strong plea was made for the interchange of meteorological information. For example, some years ago, clouds at unusually high altitudes were reported, but this fact was seemingly not well known throughout the meteorological services.

The present trend seemed to be to design aircraft to fly through normal icing risks, but to avoid catastrophic icing. Doubt was expressed as to whether kinetic heating would prevent ice formation.

HERE AND THERE

SLEIGH-BELLS IN THE SNOW: A Dakota of the Russian Air Force, with American serial number still on the fin, co-operating with an equally dependable form of terrestial transport in the snowy wastes. Russian-built aircraft of similar type have the loading door on the starboard side.

Swept Fury

THE irritating, and possibly dangerous, practice of duplicating existing aircraft names has frequently been remarked on in these columns. It is now known that the North American FJ-2, the U.S. Navy's deck-landing version of the F-86 Sabre, is designated "Fury," as was its straight-wing forerunner the FJ-1. The prototype of the FJ-2 first flew on February 19th. Like the Avon-powered Sabres to be built in Australia, it is armed with four 20 mm guns.

Research Equipment on View

TWENTY-EIGHT items of research apparatus contributed by seven establishments of the Ministry of Supply, will be included among the exhibits at the Physical Society Exhibition, Imperial College, South Kensington, from April 3rd to 8th.

Russian Bombers—

ACCORDING to American intelligence reports from Washington, Russia now has a long-range bomber, known as the "Type 31", which could fly to the United States and back. The "Type 27" light bomber (believed to be of Ilyushin design and illustrated frequently in *Flight*, the last drawing having appeared on January 11th) is said to have a range of 1,300 miles and a speed of about 500 m.p.h. A second, "Type 35", is faster. About 800 of these two latter types are believed to be in service and the annual production is estimated at about 1,000.

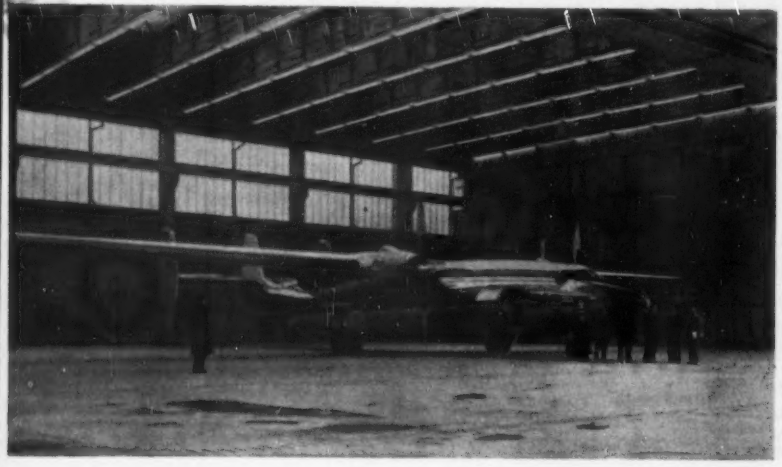
—and Chinese Losses

IT is also reported from Washington that the Chinese Air Force operating in Korea has about 1,700 aircraft—about 900 of them jets. In combats up to February 1st between Mig-15s and F-86 Sabres, 166 Migs were lost for 23 Sabres. Losses in the air up to February 1st are given as: Communists 279, United Nations 40; in close support, Communists none, United Nations 65; in interdiction, Communists none, United Nations 296.

Paper Money

STRIKING evidence of the rise in the cost of paper comes from Fort Dunlop, which sent 405 tons of waste, valued at £6,066, to the collectors last year. This is 11 tons more than the year before; but the value had gone up by £4,170. The recovery of waste paper is a vital task, and every firm or individual who can assist in this way performs a national service. Names and addresses of waste-paper merchants throughout the country can be obtained from the Waste Paper Recovery Association, 52 Mount Street, London W.1.

NEW SETTING FOR SHAKESPEARE: On February 21st the first bay of the new British European Airways' hangar at London Airport came into use when the Elizabethan R.M.A. "William Shakespeare" took up residence. The next four bays are due to be completed at intervals of approximately six weeks. The completed hangar will consist of ten bays.



Morane Turbine Trainer

CONSTRUCTION of a new turbojet trainer—the Morane Saulnier M.S.755—is already under way in France, and the machine should fly next autumn. The M.S.755 is powered by two Turboméca Marbores of 880 lb thrust apiece. The retractable undercarriage is of nosewheel type, the tail unit of "T" form, and instructor and pupil are seated side by side. Two guns can be fitted, or two rockets, or two 110 lb bombs. Dimensions are: span, 31ft 5in; length, 31ft 3in; empty weight, 3,307 lb; gross weight, 7,874 lb. The estimated ceiling is over 39,000ft and the maximum continuous cruising speed a shade under 400 m.p.h. at 19,700ft. The machine has been designed to full aerobatic factors.

Another French Prototype Lost

IT is reported that a French fighter-bomber prototype "exploded" in the air near Vichy on the night of February 21st. The aircraft, of unspecified type, was stated to be a second prototype, the first having met with a similar fate two years ago. From this information, it is fairly safe to assume that the type concerned was the Arsenal VG-90 deck-landing fighter-bomber, powered by a Hispano Nene, for the first VG-90 was destroyed on May 25th, 1950. The possibility of sabotage is not being overlooked; an abnormal number of French prototypes have been destroyed in recent years.

Orenda Type-test

THE production model of the Avro Canada Orenda turbojet has successfully completed an official 150 hr type-test. An Avro Canada spokesman has stated that its completion is most opportune as related to the building and production programmes. "The brick-and-mortar phase in the construction of the new Avro Canada jet engine plant is rapidly nearing completion," he added. Progress in the new plant within the next few months will be confined to the placing of machines and equipment, and in tool try-outs prior to accelerating operations towards the achievement of peak schedules.

Meeting of Avro Veterans

DUE to take place in London last Tuesday, February 26th, was the first re-union ever to be held of those Avro employees who were either apprentices or key personnel of the firm before the end of 1915. Some twenty-six names appear on the invitation list, many of those elegible still being with the company. We hope to publish an account of the occasion in our next issue.

TYPICAL of the scene at many Royal Air Force airfields during exercises, the illustration shows a fighter squadron preparing to take off. Continuous technical research puts Esso in the forefront of the developments of aviation fuels and lubricants for all the latest British aero engines.

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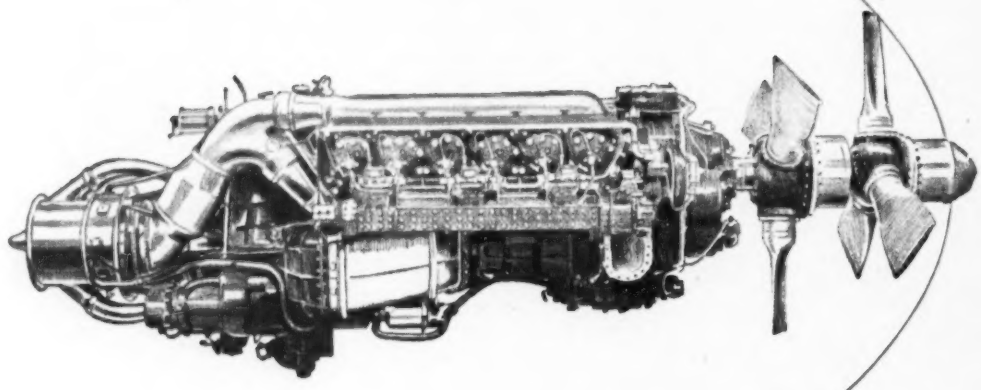

NOMAD

In this, the world's first composite gas turbine/piston engine, Napier have drawn upon their wide experience of aircraft diesel and gas turbine development to produce an engine of unparalleled economy. Successor to Napier engines that have made history, the Nomad is a further mark of Britain's technical leadership in the science of aircraft propulsion.

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HERE AND THERE . . .

S.B.A.C. Show: Extra Public Day

THE S.B.A.C. has now announced officially that this year's Flying Display and Exhibition at Farnborough will be extended by a day. The technicians' day and Press preview, originally fixed for Tuesday, September 2nd, will be put forward to the Monday; Tuesday, Wednesday and Thursday will be "trade" days; and this will leave three days (Friday, Saturday, Sunday, 5th, 6th and 7th), in which the general public will be able to attend.

Long-distance Met.

MR. NIGEL BIRCH, Under-Secretary of State for Air, told the Commons on February 20th that during this year it was hoped to set up several more meteorological stations on the Commonwealth air routes. Nine stations, making regular observations up to a height of 60,000ft, were already in service. They provided more detailed information about weather conditions at high altitudes than was available anywhere else in the world.

The Re-rising Sun

FOLLOWING the first signs of a revival of Japan's air-transport industry—one company, under American control, has been operating for some months—there is news from Tokyo that aircraft manufacture is now likely to begin. With government assistance, production on a small scale is likely to be started towards the end of this year. Japanese engineering firms are already tendering for the supply of armaments, such as trench-mortars, to the U.S. armed forces.

Hindustan's Next

A CURRENT project by Hindustan Aircraft, Ltd., Bangalore—builders of the Hindustan HT-2 basic trainer—is an advanced trainer with Pratt and Whitney R-1830 engine. A mock-up has been built and wind-tunnel models are being tested. The company—which has among its activities the building of buses and railway carriages—has also assembled a number of Vampires; it is stated that preparations for the complete manufacture of these aircraft are being made.

CANBERRA CREW: S/L. C. E. De Vigne, D.S.O., D.F.C., A.F.C. (right) and F/L. P. L. Hunt photographed at Castel Benito after flying a B.2 Canberra—as we reported last week—from London Airport at a record average speed of 538.13 m.p.h. S/L. De Vigne is civil test pilot.

"We're scraping the bottom of the barrel now."

Stratojet Developments

THE first Boeing B-47C airframe is now complete and will fly as soon as all four Allison J-71 turbojets have been delivered. Although these engines provide increased thrust in comparison with the six J-47s originally used there are official U.S.A.F. indications that the production B-47C will be powered by the Pratt and Whitney J-57—probably in the same form of twin pod employed on Boeing's much larger B-52. Another Stratojet development, which has long been considered for its long-range potential, will be turboprop-powered. Now that there is a likelihood of a prototype being built it is interesting to note that the power plant chosen is a development of the Curtiss-Wright J-65 Sapphire in preference to one of the more highly-developed American turboprops. This new power unit the potentialities of which promise to be of considerable importance will drive a Curtiss gearbox and high-speed airscrew.

MAJ. GEORGE DAVIS, U.S.A.F., in the cockpit of his F-86. This fine pilot, whose score of Communist aircraft in Korea totalled 11 fighters and three bombers, was recently reported missing, believed killed, after a fight with two Mig-15s; he was not seen to bale out.

IN BRIEF

THE northern sales office of Bakelite, Ltd., and of their associated company Warerite, Ltd., has moved into more spacious quarters at The Royal Exchange, Manchester 2 (Blackfriars 5174-7).

* * *

The Alan Muntz aircraft section has now been removed from Heaton to Langley: the new address is Alan Muntz and Co., Ltd., Aircraft Section, Langley Aerodrome, Bucks.

* * *

Under the title *Instrument Shock Testing Theory and Measurement*, a booklet from Haines Designed Products Corp., 117 N. Findlay St., Dayton 3, Ohio, includes a concise account of the use of the corporation's shock-testing machine, together with numerous specimen oscillograms from its use.

* * *

A record number of 167 cash awards, totalling £1,536 15s, was made by the Dunlop Rubber Company to its employees last year. Among these awards were grants of £15 to successful candidates for the Higher National Certificate in Aeronautical Engineering, and of £10 to employees obtaining a similar National Certificate.

* * *

In a recent reference to the "Reservoil" sintered-metal bearings made by the Morgan Crucible Co., Ltd., it should have been made clear that the material of which they are composed may be machined only in exceptional circumstances. Manufacture is by the powder-metallurgy process, utilizing the pressing of closely controlled, finely granulated metal powders, with heat treatment and subsequent sizing to close limits by further pressing.

BRITANNIA POTENTIAL

The New Bristol Airliner: A Survey of Performance Estimates

By C. B. BAILEY-WATSON

A MONTH ago—in *Flight* of January 25th—we gave a brief general appraisal of the Bristol 175 Britannia and it is now timely to devote rather more detailed attention to the operational potential of the aircraft. The picture is an impressive one.

The first prototype of the Britannia is expected to make its maiden flight in the coming summer. Let it be said at once that the sooner it flies through its test programme and gets out into B.O.A.C. service the better, for in this new airliner Great Britain has a commercial aircraft which promises to be so versatile and yet so economically efficient that it must ultimately take its place as a world-beater. What makes an aircraft a world-beater? Briefly, superlative fitness for purpose. When it can carry a greater payload farther, faster and more cheaply than can its competitor types, then that aircraft is a world-beater. Such we believe the Britannia will be.

It is, of course, implicit that this belief is based on performance estimates, for until the 175 completes its flight trials and finite measurements can be assessed, one can deal only with expectations. Nevertheless, because the Bristol Aeroplane Co., Ltd., have gone into the whole matter so thoroughly and so carefully, the figures they quote can, we feel, confidently be accepted without the more common reservations.

Before going on to examine some of the performance estimates it may be advantageous to re-state briefly the basic form of the Britannia's design. It is a straightforward low-wing aircraft powered with four Bristol Proteus 3 turboprops, and with a tricycle undercarriage and single fin and rudder. The fuselage for the greater part of its length is a cylindrical trunk of 12ft diameter, and the wing is moderately tapered, very slightly swept back, and has an aspect ratio of 9.53. Superficially there appears to be little about the Britannia to indicate that it is in any way out of the ordinary. But figures like 4,000 (long) ton-miles per hour and a volumetric payload capacity of 25,000 lb emphasize that there is much more in it than meets the eye. And so there is.

For a start, the percentage structure weight is 24.4 on 130,000 lb—a figure which, low enough in all conscience, is reduced to an even lower value when the developed all-up weight of 140,000 lb is considered. With this is a power installation percentage weight of but 14.4 (again on 130,000 lb a.u.w.). In this context, it is apposite to note that although 130,000 lb is the figure specified for guarantee purposes, the a.u.w. of the Britannia is likely to be 140,000 lb from the start; therefore, whilst the performance values on the basis of 120,000 lb must be taken as the foundation in this article, the enhanced values relative to 140,000 lb are, in the event, the more likely to be realized. To short-cut the tabulation we can state that, according to the accommodation layout employed, the basic operational weight percentage varies from 54.3 down to 49.5. The remainder is made up of crew, payload, fuel and oil.

The cabin of the Britannia is floored a little below the centre line of the fuselage, and in the under-floor space are two freight holds *of rectangular section*, the forward volume being of 308 cu ft, and the rearward volume 360 cu ft. In addition to this 668 cu ft of freight stowage capacity there are two baggage compartments above cabin floor-level, together totalling a further 120 cu ft. In all, therefore, the aircraft has 788 cu ft of stowage space outside the passenger cabin.

We mention this stowage capacity in detail because it has a direct bearing on the volumetric payload. Most operators have their own formula for calculating this particular factor, but the accepted standard laid down by the S.B.A.C. is representative. It is :—

$$\left\{\begin{array}{l}\text{No. of}\\ \text{pass.}\\ \text{seats}\end{array}\times\begin{array}{l}\text{Wt. of}\\ \text{unit}\\ \text{pass.}\end{array}\right\}+\left\{\begin{array}{l}\text{0.9 gross vol. of}\\ \text{all freight and}\\ \text{baggage holds}\end{array}\times\begin{array}{l}\text{Density of}\\ \text{freight and}\\ \text{baggage}\end{array}\right\}\text{ lb}$$

The density of freight and baggage is taken for this purpose as 14 lb/cu ft for the aggregate volume of all the freight and baggage holds. The above formula can therefore be reduced to :—

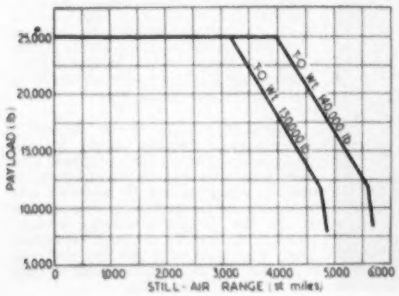
$$\left\{\begin{array}{l}\text{No. of}\\ \text{pass.}\\ \text{seats}\end{array}\times\ 165\right\}+\left\{\begin{array}{l}\text{12.6}\times\text{gross vol.}\\ \text{of all freight and}\\ \text{baggage holds.}\end{array}\right\}$$

According to this formula, the volumetric payload of the Britannia works out at 18,110 lb. But Bristols quote a figure of 25,000 lb. As the unit passenger-weight is the same at 165 lb, the inference is that the payload density calculated by Bristols must be higher. If, therefore, we subtract the passenger weight from the final payload weight, and divide the result by the freight hold volume, we arrive at Bristol's density figure, which then has to be cut by 10 per cent to accord with the S.B.A.C. method. On this basis, the 90 per cent density works out at 19.08 lb/cu ft for the 50-seat version of the aircraft—an extraordinary achievement. At the other end of the scale, i.e. for the 104-seater version, the 90 per cent density is 8.9 lb/cu ft.

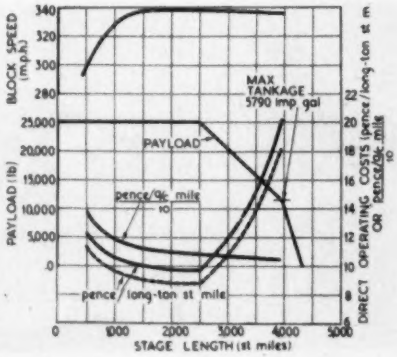
Expressed in other terms, it can be stated that the 50-seater will carry 16,300 lb, or just over 7 tons, of freight and baggage in addition to its passengers, whilst even the 104-seat "air coach" version will carry 7,424 lb (3 tons) of additional load. So far as carrying capacity is concerned, therefore, the Britannia can be regarded as an outstanding aircraft.

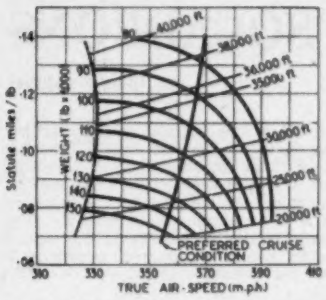
The bare ability to carry a given load or range of loads may not, however, in itself be of cardinal importance. To obtain the full measure of commercial effectiveness, it is necessary to relate load capacity to distance and time. The term "ton-miles" expresses load-for-distance, and in this connection the Britannia has the astonishing ability to carry its full payload of 25,000 lb (11.16 tons) over a still-air range of 3,175 statute miles (see Fig. 1). If the payload is reduced in favour of more fuel, the figures are 10,000 lb (4.46 tons) for a still-air range of 4,820 miles. These values are for a take-off weight of 130,000 lb and, of course, are proportionately increased when the take-off weight is put up to 140,000 lb. On

Fig. 1. Payload for s.a. range (no allowances). Assumptions: I.S.A.C.; max. cont. power; t-o.w., 130,000 lb; mean cruise, 364 m.p.h.; mean height, 32,000ft; fuel, 5,790 Imp. gal. For t-o.w., 140,000 lb, mean cruise is 363 m.p.h., mean height, 30,000ft; and fuel 7,000 Imp. gal.



(Fig. 2. (Right) Economic data curves based on S.B.A.C. standard method for direct operating-cost estimation. Conditions assumed: still air; max. cont. power; t-o. weight, 130,000 lb; taxying allowance, 5 min. Cost curves in solid line represent 21d/Imp gal, and in dotted line 15d/Imp gal.





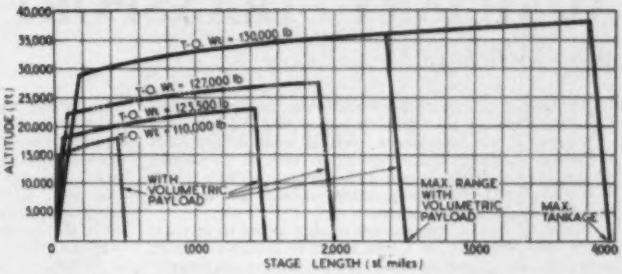

ALTITUDE (ft)
T-O. Wt. = 130,000 lb
T-O. Wt. = 127,000 lb
T-O. Wt. = 123,500 lb
T-O. Wt. = 110,000 lb
WITH VOLUMETRIC PAYLOAD
MAX. RANGE WITH VOLUMETRIC PAYLOAD
MAX. TANKAGE
STAGE LENGTH (st. miles)

Fig. 3. (Left) Specific-range curves illustrating preferred cruising condition. Assumptions: all engines operating at max. cont. power; International Standard Atmospheric Conditions; propulsive efficiency 0.87; power allowance for auxiliaries, 65 b.h.p. per engine. Fig. 4. (Right) Variation of flight-plan with stage-length using S.B.A.C. fuel allowances.

this basis, the 25,000 lb payload can be carried over 4,000 miles, and the 10,000 lb payload over 5,670 miles.

It is worth noting that the payload-range capacity of the heavier version of the Britannia is such as to enable it to fulfil the range minimum for a regular scheduled non-stop service between London and New York.

Having related load capacity to distance, it is possible by bringing in the third term, time, to derive a load-capacity/speed value in the expression "ton-miles per hour." In that it defines a rate-of-delivery factor, this compound term serves as a useful revenue index, whereby the comparative commercial efficiency of aircraft can be measured. Taking the mean cruising speed of the Britannia at 365 m.p.h., the revenue index for the aircraft becomes the extraordinarily high figure of 4,060 ton-miles per hour. Bare statistics are apt to be a little boring; but, to bring home what this revenue index means in terms of working capacity, one can transpose the terms. Thus, we can say that the Britannia has a payload delivery capacity equivalent to carrying 4,060 tons one mile in an hour or, conversely, carrying one ton 4,060 miles in an hour. Although in practicality these values are nonsense, statistically they are true enough, and do serve to indicate what an immensely useful commercial aircraft the Britannia will be.

We now have some broad basis of judgment as to capabilities of the aircraft. What of the cost? The price breakdown per aircraft is as follows: equipped airframe, less power units and airscrews, £389,000; power units, less airscrews, 4 × £26,000 = £96,000; airscrews with ancillary equipment, 4 × £3,750 = £15,000; radio equipment, £10,000. Thus the basic prime cost totals £510,000. Half a million plus is, of course, a great deal of money, but the figure is competitive with that for other new types with which the Britannia will compete. Such is the estimated efficiency of the aircraft, however, that the expected profit-margin from its operation is more than competitive.

Based on the S.B.A.C. standard method for estimating direct operating costs, the economic data for the Britannia are synthetized in Fig. 2. The immediately noteworthy fact is that the block speed curve is virtually flat at 338/336 m.p.h. over a range of stage lengths from 1,500 miles upwards. This has its resultant effect on the shapes of the specific cost curves, and the achievement of a direct operating-cost of but 8.8 pence per ton-mile with the full volumetric payload of 25,000 lb for a stage-length of 2,500 miles is outstanding. It is, certainly, computed for a fuel cost of 15d/Imp gal, but even at 21d/gal the cost rises only to 9.7d.

The block speed is maintained at a high value even over short ranges, this being made possible by flying at below the "preferred" cruise altitude shown in Fig. 3. Ideally, the flight plans for various stage lengths from 500 up to 3,950 miles are as shown in Fig. 4, and these plots clearly illustrate the basic mode of operation for optimum results, viz. a rapid climb to the initial cruise altitude, followed by a slow en route climb (balancing fuel consumption) up to a peak altitude reached 50-200 miles from destination, and from which the let-down is made. As is to be expected, the climb gradients to the initial cruise altitude show some measure of diversity according to stage length, although the en route climb gradient remains the same.

For the shorter stage lengths, the direct operating costs vary markedly with cruising altitude, this being shown graphically in Fig. 5, which is constructed for a stage-length of 500 statute miles, with a fuel cost of 15d/Imp gal. For this stage-length, the initial cruise altitude for the "preferred" cruise condition (take-off weight 106,600 lb) is 35,000ft. The corresponding block speed is 246 m.p.h., and the direct cost is 13d/ton-mile. By reducing the initial cruise altitude to 15,000ft, the fuel consumed, fuel carried, and take-off weight are increased, but as the block speed is raised to 302 m.p.h. the direct cost is reduced to 12.4d/ton-mile. The effect is shown graphically, in a different manner, in Fig. 6, which illustrates a series of alternative flight-plans, and confirms that the optimum results are obtained by climbing to an initial cruise altitude of 20,000ft, whence the block speed becomes 293 m.p.h., and the cost per ton-mile is reduced to 12.2d.

We have not been able here to make much more than a cursory appraisal of the commercial potential of the Britannia; even so, it is enough to indicate that we are on pretty safe ground in offering the opinion that in this new airliner Great Britain has a commercial aircraft which promises to be so versatile and yet so economically efficient that it must ultimately take its place as a world-beater.

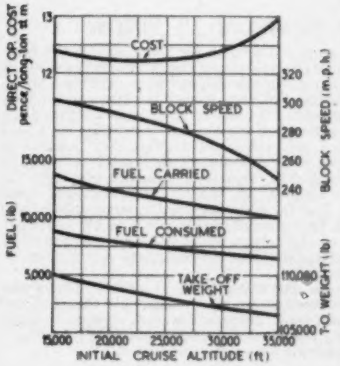


Fig. 5. (Left) Effect on direct operating cost and block speed of variation in cruising altitude for stage-length of 500 miles. Direct operating cost estimated according to S.B.A.C. standard method with fuel cost assumed at 15d/Imp gal.

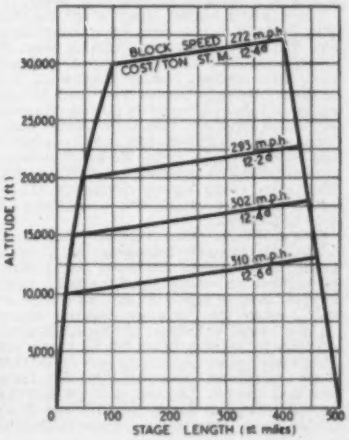


Fig. 6. (Right) Flight plans for 500-mile stage-length showing effect of variation in cruising altitude in terms of block speed and direct operating costs. These plots should be read in conjunction with Fig. 5.

AUXILIARY TRANSPORT SQUADRONS

Why the Hold-up?

By HENRY MORRIS

THERE is considerable speculation as to the whys and wherefores of the complete hiatus that has occurred since it was announced, several months ago, that additional Auxiliary R.A.F. squadrons were to be formed by certain of the independent civil operators. There is still only the original prototype squadron in being and no signs of the imminent birth of others.

Month by month international tension seems to increase and a new "incident" or a new threat to Britain's security brews up. Every such incident calls for some quick transfer of Service personnel, of hapless and harassed British civilians, or of stores and equipment; and in all such moves there are signs that air transport is a bottleneck. It is now generally accepted that ample and efficient air transport capacity is a "prime strategic" requirement for any major power; but so far as the United Kingdom is concerned the general rearmament situation does not seem to offer any strong hopes that the manufacturing resources of the country can turn out even a fraction of the air transport capacity the country needs if it is to play a really effective part in increasing the defensive and offensive weight of the NATO powers.

In these circumstances one would expect the establishment of additional air-transport squadrons to be considered a matter of great urgency. The longer they are delayed the less enthusiasm there will be for their formation, and the shorter training time will there be left for bringing their volunteer personnel up to a reasonable standard of efficiency.

The companies already chosen for the formation of additional Auxiliary Squadrons are, as far as one knows, still prepared and very eager to go ahead, so where and what is the hitch? Surely this scheme has not become involved in the Government's economy drive? The case for the formation of these squadrons is, if anything, strengthened by that increasing need for economy and the added urgency impelling the rearmament programme. The more difficult it is to secure raw material for new equipment, new manpower for manufacturing that equipment, and personnel for manning it, the more essential is it to make certain that any existing available source is used to the full.

The economics applicable to the operation of these squadrons should be very attractive to the Treasury. Whatever the actual cost of organizing and maintaining this very specialized type of unit it can be but a fraction of that required for the normal Auxiliary squadron, and almost infinitesimal compared with the maintenance of a Regular squadron. The country is assured of a nucleus of experienced aircrews in full flying training and there is little or no additional Service training required for an aircrew who are in any case flying many days a month on their own business. Moreover, these specialized units should be most attractive to potential recruits. Outsiders joining them would be given training of the highest quality, would be associating with people to whom air transport is bread and butter and not a spare-time hobby, and would have the opportunity of flying along routes normally well off the beaten track of regular squadron training.

Enthusiasm cannot be kept indefinitely at high pitch. It is essential that the uncertainty be ended, and the squadrons started off as quickly as possible while the energy and keenness still exist.

U.S.A.F. STRENGTH in KOREA and EUROPE

THAT there are now eighteen U.S.A.F. combat wings operating against Red China in the Far East and nine combat wings "guarding the western side of the Iron Curtain in Europe" is disclosed by *Aviation Week* on the authority of official sources. Of this total force less than half is considered modern in terms of equipment. Though the U.S.A.F. is taking action to modernize its Far East fighter units, and will shortly replace the last of its North American F-51 Mustang piston-engined fighters with Republic F-84 Thunderjets and North American F-86 Sabres, these machines are still badly outnumbered. In Europe, our contemporary reports, while the U.S.A.F. and U.S. Navy are gradually establishing a network of bases from England southward across France, North Africa, and eastward to Turkey, equipment is being modernized only slowly.

The eighteen combat wings of the Far East Air Force now flying in Korea include eight fighter wings using F-51 Mustangs, F-82 Twin-Mustangs, F-80 Shooting Stars, F-84 Thunderjets, F-86 Sabres, and F-94s (all-weather development of the Shooting Star); three medium bomber units, using Boeing B-29 Superfortresses; two light bomber wings with Douglas B-26 Invaders; one tactical reconnaissance wing flying Mustangs, Shooting Stars and RB-26 Invaders; four troop carrier wings operating C-46 Commandos, C-54 Skymasters and C-119 Packets; a few strategic reconnaissance units flying RB-29 Superfortresses and RB-45 Tornadoes; and rescue squadrons equipped with Grumman SA-16 Albatrosses, SB-29 Superfortresses and SC-47 Dakotas. Additionally there are considerable quantities of Sikorsky H-5 and H-19 helicopters.

Official U.S.A.F. sources indicate that no immediate plans are in hand for materially increasing strength in the Korean theatre, though several fighter and troop carrier units are standing by for possible movement should present requirements change. Some build-up in fighter strength for tactical and ground support work is under way "as a precautionary measure."

Units based in Europe, although completely equipped, are, according to *Aviation Week*, "in force only sufficient to provide thinly spread policy (*sic*) activity in occupied Germany." U.S.A.F. forces available in Europe (U.S.A.F.E.), include four wings in Germany, three in England, and two in France. In Germany the 60th and 433rd Troop Carrier Wings fly Fairchild C-82 and C-119 Packets, while tactical support is provided by the 36th and 86th Fighter Bomb Wings, using Thunderjets. In England reserve forces include one fighter bomber wing, equipped with Thunderjets, and the 81st Interceptor Wing, armed with Sabres. In addition, the Strategic Air Command has one B-50 bomber wing —the 93rd—under training in England.

In France, U.S.A.F.E. strength is comprised of the 126th Light Bomb Wing (Douglas Invader) and 117th Tactical Reconnaissance Wing, flying RF-80 Shooting Stars and RB-26 Invaders.

Bases under construction or in negotiation for construction in France, Spain, North Africa and the Middle East are, for the most part, "some time away."

"Unofficial sources," states *Aviation Week*, "report that tactical and strategic air as well as troop carrier air is slated for at least doubling in strength during the next two years. But official sources say that the outlook for any real material increase in U.S.A.F.E. strength is a dim one for twenty-four months at least."

THE RUSSIANS AT FINOW

ONE of the best-equipped Russian Air Force bases in Germany is at Finow (30 miles north-east of Berlin), where the runways and dispersal areas have lately been strengthened. A modern drainage scheme has been installed, and fuel tanks have been noted above and beneath the ground in the former Schering-Kahlbaum plant at Wolfswinkel, north-east of the airfield. In addition to a permanent radar station, installed in wooden huts, there is a mobile radar van and mobile R/T. A T-shaped aerial nearly 50ft high is reported, and a powerful beacon rotates permanently at night.

Aircraft present are some 90 Mig-15s, six Pe-2s, and some Tu-2s and Il-26s. The Pe-2s are employed as target tugs for the benefit of the Migs, the training flights of which usually last about 20 min. There is no night flying by the Migs but they are often seen with rocket projectiles, which they discharge against mocked-up tanks at Gersdorf.

No estimate of personnel strength can be formed. The operational pilots are reported to be very young, and female pilots are said to have been seen. Security has been tightened within the last few months, and one unfortunate citizen who stayed for a minute by the roadside was promptly apprehended.

The Royal Air Force have adopted . . .

Pembrokes for communications . . .

Pembrokes for freighting . . .

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THE

"Pembroke"

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of the next generation

Trials proceed apace:
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been surpassed

DE HAVILLAND

FLIGHT, 29 February 1952

At Tjunajokk, Lapland. The Norduyn Norseman has just arrived on the "fish run" from Gällivare, 50 miles north of the Arctic Circle.

FLYING FISH

Lapland's Sea-food Air Freight

By ARVID KJELLBERG

LAPLAND'S "fish airlift" is probably unique in the world of aviation. The lakes and rivers of Swedish Lapland are rich with fish; here we have always been able to get all the fresh trout, salmon and char (a variety of Arctic salmon) we need, and in the past we often discussed the possibility of flying fish to Stockholm and even to Denmark.

An electrified railway which runs northwards through the very centre of the country offers a means of freighting out as much fish as we can catch; indeed, it handles a considerable tonnage every year, and refrigeration makes it possible to sell the fish as far away as Germany. Such advertising slogans as "Flown from the Arctic to your table" catch the eye, appeal to the imagination, and bring a response from the fishmongers, who know that the added cost is more than balanced in the minds of their critical customers.

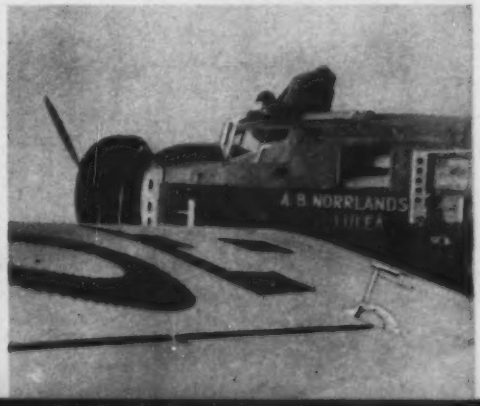
The aircraft employed are fitted with floats in summer and in winter with skis for landing on the frozen lakes. In winter the aircraft are normally loaded from lorries, or sometimes from sledges drawn by reindeer. Neither winter temperatures of 30 and 40 below zero, nor the darkness of the months-long northern night, bring flying to a halt. It will be remembered that bombers and fighters were fully employed on the Russo-Finnish front east of Murmansk during the war, even in the coldest weather. So it is with civil aviation in Swedish Lapland, thanks largely to an efficient meteorological service. The fish run is cancelled only in the worst weather.

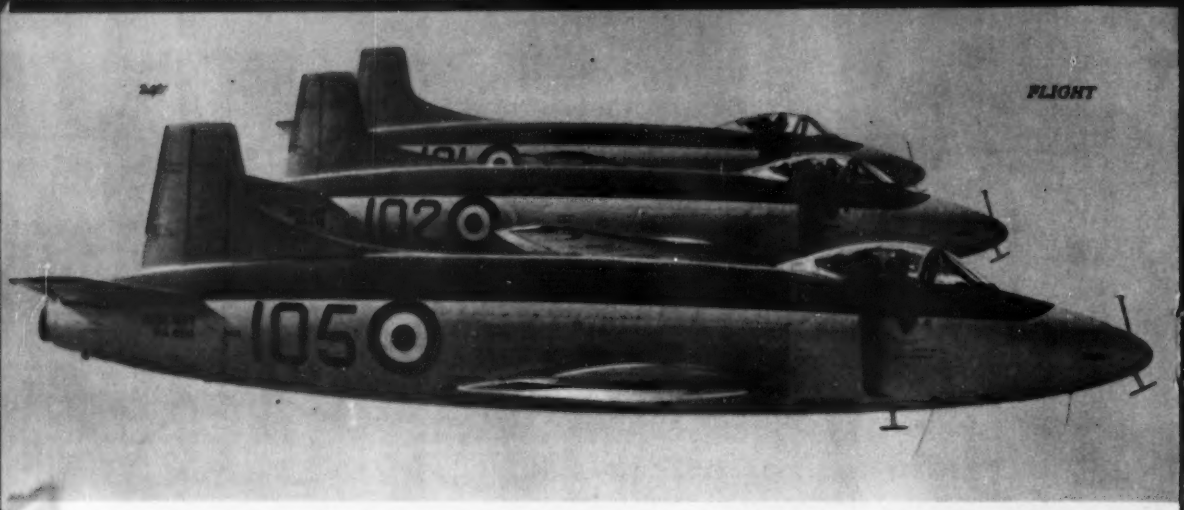
In summer the aircraft are loaded from rudimentary wooden wharfs built against the banks of lake or river, at the nearest point to a road or track. Fuel is brought in by rail, costing only a fraction above the normal price.

Daily flights are made at the height of the fishing season, as many as three aircraft sometimes being engaged in ferrying the fish southwards. Air freight costs are up to three times those of the railway, but the fish still finds a ready market.

(Above) *There is a strange blend of ancient and modern in this view of fish being brought ashore while a Republic Seabee amphibian waits on the ice in the background.* (Below) *The two aircraft seen on frozen Lake Sazzas are Klemm Kl 35s.*

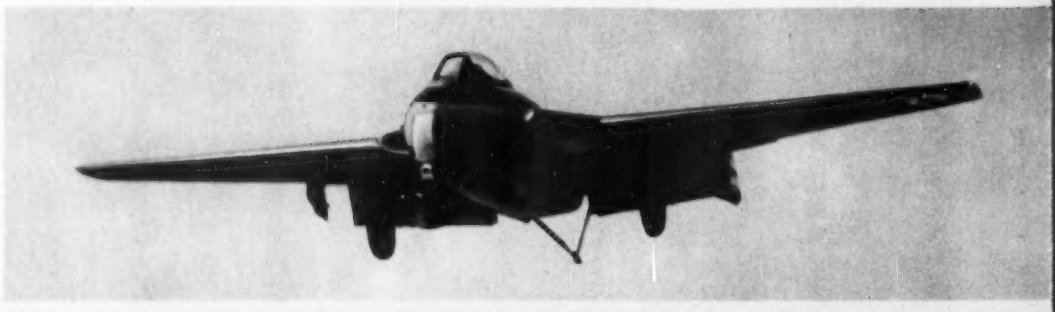
(Above) *Two girls of Lapland, in picturesque costume, assist in loading the Seabee.* (Below) *Yet another aircraft—and one of the larger and more suitable—among the strange variety used on the fish-transport operations is a Junkers W34.*

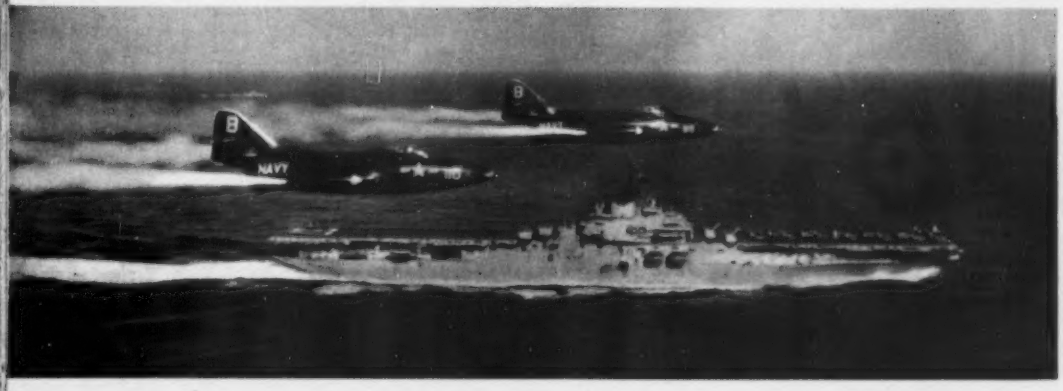




FIGHTING FOR THE FLEET

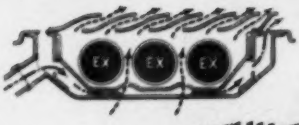
Six Jet-propelled Single- and Multi-seater Types in Naval Service





FEW aircraft specifications are as exacting as those for carrier-borne fighters. The design of a land-based fighter is difficult enough, but the naval counterpart, while losing little or nothing in performance, must meet stringent requirements in matters of pilot view, flotation characteristics, slow-speed flying qualities, and provision for special naval equipment, while it must also be able to land on a carrier, carry plenty of fuel, and yet fold into a small space when necessary. Even when folded, it must have a low c.g. so that it does not tip up when the carrier rolls.

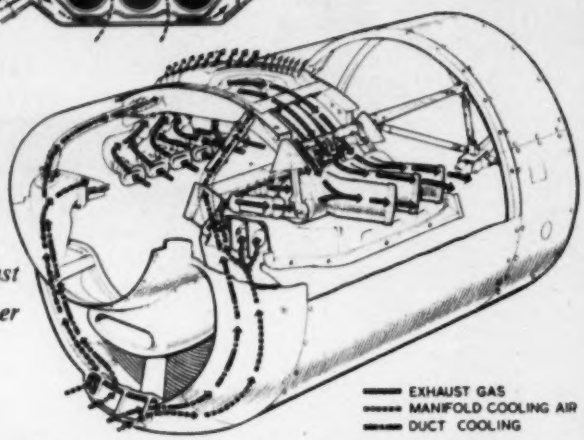
That such diverse demands can be met by widely different aircraft is illustrated by these photographs of current types of naval fighter—all of which are in operational service. The neat echelon of Vickers-Supermarine Attackers (top, left) reflects the high standard of No. 800 Squadron, to which the aircraft belong. Below them, a de Havilland Sea Vampire makes its approach, displaying a large flap area; the type is not standard squadron equipment, but numbers are in service for training and research. At the foot of the left-hand page, two McDonnell F2H Banshees from the U.S.S. *Essex* are looking for opportunities in Korea. The massive Douglas F3D Skyknight (top, right) equipping night and all-weather units of the U.S. Navy, is shown with a member of the crew using the "laundry-chute" escape tunnel; while below it two Grumman F9F Panthers jettison fuel from their tip tanks as they fly past the Skyraider-packed U.S.S. *Princeton*. Finally, the Hawker Sea Hawk is now entering service; the photograph (bottom, right) shows a prototype on board H.M.S. *Illustrious* for proving trials. Production Sea Hawks are now coming off the line.



SECTION OF CROSS-OVER

QUIETER ARGONAUT

Details of the Merlin Cross-over Exhaust System: Less Noise Yet More Power



This diagram shows the cooling-air and exhaust-gas flow pattern and also illustrates the method of suspending the exhaust system from a sub-frame which transfers the weight to the engine bulkhead.

FIRST announced some months ago, the cross-over exhaust system developed for the Merlin T.M.L.* power plant by Rolls-Royce, Ltd., is now entering B.O.A.C. service—in particular, all four engines of the Argonaut *Atalanta*, in which H.M. The Queen recently flew to Kenya and back, were fitted with it.

Both Rolls-Royce and B.O.A.C. have long appreciated the fact that the Argonaut (Canadair DC-4M) could well be made a quieter aircraft; to do so, however, and lose nothing in the way of performance, was a much greater problem, and Rolls-Royce have spent a considerable period in finding the best solution. It must therefore be with some gratification that they can now announce the development of this new exhaust system which, while effecting a marked reduction in noise level, actually improves performance.

B.O.A.C. recently afforded us the opportunity of examining this new power plant—redesignated Merlin T.M.O.—at London Airport, and the accompanying photographs show the system to good advantage.

Beside each cylinder bank, and suspended from a sub-frame off the main bulkhead, is a cylindrical manifold into which the adjacent cylinders exhaust *via* ball-jointed stubs. The two manifolds of each power plant are symmetrically connected by three stainless-steel pipes which carry the exhaust from the inner bank of each engine over to the outer manifold; final release to atmosphere is made through three stubs ejecting on the outer side of each cowling.

The manifolds and primary exhaust stubs are made of Inconel, and are designed to be free from stresses arising from engine vibration, while affording the clearest possible gas path. The system is cooled by air drawn in at an intake placed centrally on the lower lip of the main radiator intake. This position receives the full benefit of both airscrew slip-stream and ram air, and results in effective cooling under all conditions. From the new intake the flow is divided, one stream cooling the primary stubs and the adjacent ignition harnesses, while the other passes over the connecting pipes; both exhaust from herringbone-shaped louvres above the cowling.

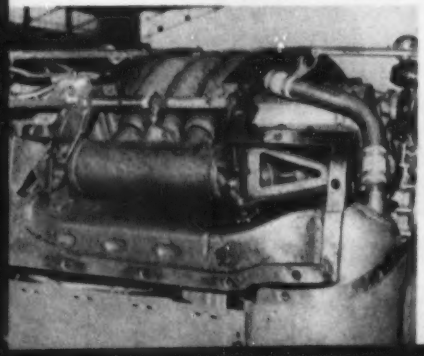
The cross-over modification also involves replacement of the existing main coolant radiator by a unit made entirely of light alloy, while a new circular brass oil-cooler is also specified. The modified power plant is interchangeable port and starboard by fitting the appropriate ejector-stubs to the outer side of the engine, and the correctly handed blanking-plate on the fuselage side. The new exhaust system is completely interchangeable with the original system, the only parts affected being the valve rocker-box covers, ignition harness, and fire extinguishers, all of which are supplied by Rolls-Royce in the modification kit.

The reduction in noise is achieved both by exhausting away from the fuselage—exhaust flow, incidentally, is entirely above the wing—and also by the mutual cancellation of many of the harmonic constituents of the noise spectrum. Throughout, close attention has been paid to providing unrestricted gas-flow, and to reducing installation-drag; the result has been a back-pressure reduction giving an additional 38 b.h.p. at maximum power per engine in comparison with the original Merlin T.M.L., while the cleaner installation results in a gain in T.A.S. of some 5 kt over the range of cruising speeds. The factors combine to increase the specific air range of the Argonaut by some 4 per cent, and to reduce the noise level by between 5 and 8 decibels; the greatest silencing effect is obtained in the higher frequencies, which are those most affecting passenger comfort.

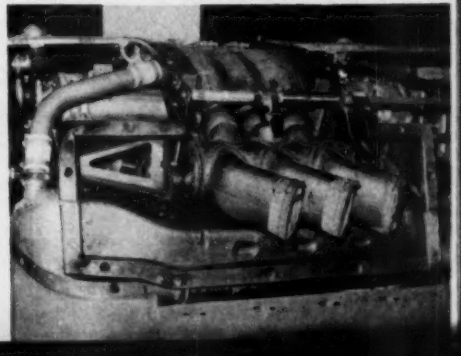
The penalties involved appear to be negligible; they

* "T.M." denotes "Transport Merlin" and is followed by a serial letter.

These views of the uncowled power plant emphasize the compactness of the new exhaust system. It has not been obtained at the expense of maintenance accessibility.



The uncowled unit from the ejection side; all twelve cylinders exhaust through the three pipes shown, although the back pressure has actually been reduced from the value with individual 10 sq in tail-pipes.



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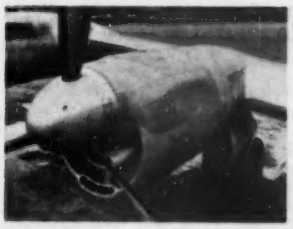

Surrounding the inner Merlin 724s of "Arcturus," the new cowling looks even cleaner than the original pattern. The blanked-off inner side (left) certainly gives the impression that "something is missing," while the larger photograph enables a comparison with the original power-plant installation to be made.

QUIETER ARGONAUT . . .

comprise an increase in exhaust-system weight of 155 lb per engine—largely offset by the saving of 106 lb made by the new light-alloy radiator—and a slight increase in the time required for the inspection of tappets and valve gear; plug changes are unaffected.

At present, Argonaut power plants are being sent to Rolls-Royce for modification as they become available. Apart from *Atalanta*, only the inner engines are being converted to the cross-over system in order to effect the maximum noise-reduction while maintaining aircraft hours at the highest level; when all the B.O.A.C. Argonaut fleet has been so treated, the aircraft will give up their outer power plants for modification until all T.M.L. Merlins have been modified to T.M.O. standard. Because it must be integrated with aircraft schedules the complete process of modifying all Argonaut power-plants is expected to take about a year.

SYNTHETIC PARACHUTIST

THE S.B.A.C. last week disclosed details of an unusual line of research at present being conducted by a parachute firm on behalf of the Ministry of Supply. Development tests of a new type of parachute are of such a nature that live drops would be inadvisable : among other things, they call for accurate simulation of an unconscious man. Elaborately constructed rubber dummies are, accordingly, being used.

The dummies are made by the Hairlok Co., Ltd., who are specialists in rubberized seat-fillings, and the parachute makers concerned are the G. Q. Parachute Co.

For the purpose of these particular trials that veteran jumper "Major Sandbags," or even an ordinary dummy man, would not give an accurate result because the distribution of weights would be wrong, as would the centre of gravity, while the dummy's movements would be false.

At first it was thought that a simple "stuffed man" would be adequate; but the experts then realized that a real man was partly "solid" inside with only soft "stuffing" on the surface. It was decided to build a steel skeleton, suitably loaded with lead and covered with rubberized Latex foam.

A set of calculations was produced based on the average crewman, taking the weight of every joint into account—the hand, wrist, lower-arm, fore-arm, etc. Every "bone" had to be the correct weight, have the correct centre of gravity, and have the right distribution of weight along its length. Over 1,200 bodies were analyzed before the statistics for this average crewman were settled.

The first parachutist was then built. He had a steel tubing spine and members, a rudimentary wooden head, and a chest of welded layers of perforated steel plate. Hairlok moulding was put round his skeleton and the whole lot put in a canvas skin.

Special spring limit-stops were placed between his joints so that, if an arm or leg were twisted to the human breaking-point during descent, the dislocation could be easily spotted on completion of tests. Any broken bones could be replaced with prefabricated ones quite easily.

Before the parachutist took off on his first flight and his first jump, he was spun vertically and horizontally to check that all his movements were articulated. They were correct to one-half per cent.

"As a final touch," says the S.B.A.C.," he was given a chessboard suit of black and white so that he would show up clearly on the test-film. Then he and several dozen more dummies like him embarked on a strenuous series of jumps to safety."

FORTHCOMING EVENTS

Mar. 4. R.Ae.S. Section Lecture: "Bogie Undercarriages," by F. A. Cousins, B.Ae.E., A.F.R.Ae.S.
Mar. 6. Institute of Metals: "Chromium and Chromium-rich Alloys," by Maj. P. L. Teed, F.R.Ae.S., M.Inst.Met.
Mar. 8. British Gliding Association: Annual General Meeting.
Mar. 11. R.Ae.S. Graduates' and Students' Lecture: "An Introduction to Supersonics," by C. H. E. Warren, M.A., A.F.R.Ae.S.
Mar. 12. R.Ae.S. Fifth Louis Blériot Lecture: "The Future of the Flying-boat," by H. Knowler, A.M.I.C.E., F.R.Ae.S. (in Paris).
Mar. 13. R.Ae.C.: Film Show.
Mar. 19. Aircraft Recognition Society: "Future Developments in Civil Aviation," by Peter G. Masefield, M.A., F.R.Ae.S.
Mar. 21. Helicopter Association: "Recent Helicopter Research Investigations," by W. Stewart, B.Sc.
Mar. 25. R.Ae.S. Graduates' and Students' Section: Annual General Meeting and Talk on "Aerodynamic Oscillations of Suspension Bridges," by C. Scruton, B.Sc., A.F.R.Ae.S.
Mar. 26. R.Ae.C.: Annual General Meeting.
Mar. 27. R.Ae.S. Section Lecture: "Civil Jet Aircraft Performance," by D. R. Newman, A.F.R.Ae.S.
Apr. 4. College of Aeronautics: Senior Common Room Society's Annual Dinner.
Apr. 6. London Aeroplane Club: Dawn Patrol and A.G.M.
Apr. 15. R.Ae.C.: Film Show.
Apr. 22. R.Ae.S. Graduates' and Students' Section: "Servo-mechanisms," by F. H. Borlase, B.Sc. (Eng.), Grad. R.Ae.S.
Apr. 24. R.Ae.S.: "Fuel Systems for Turbine-driven Aircraft," by J. E. Walker, A.F.R.Ae.S. (at Luton).
May 3. Vintage Aeroplane Club: Rally, White Waltham.
May 3-10. F.A.I.: Committee Meetings, Madrid.
May 10. Exeter Aero Club: Display.
May 10-11. l'Association des Amis de l'Aumônerie de l'Air: Cathedrals Rally.
May 17. Wolverhampton Aero Club: Display.
May 22. Aéro-Club du Dauphiné: Air Meeting, Grenoble.
May 22. Aéro-Club de France: Coupe Stomm (helicopters).
May 24-25. Ragozino-Auster Trophy Navigation Competition, Speeton, Filey, Yorks.
May 29. R.Ae.S.: Fortieth Wilbur Wright Memorial Lecture: "Prophecy and Achievement in Aeronautics," by Sir Harry M. Garner, C.B., M.A., F.R.Ae.S.
May 30-June 2. Model-flying team contest, Belgium v. Great Britain, Mamur.
May 31. Swansea and District Flying Club: Welsh Air Derby, Fairwood Common.
May 31-June 2. Aéro-Club de Cannes: International Rally.
May 31-June 2. Ailes Sparnaciennes: Champagne Rally, Epernay.
June 2. S.S.A.F.A.: Air Display, Yeadon, Leeds.

ADMINISTERING AIRWORTHINESS

The Multifarious Duties of the A.R.B.: A Lecture by the Chief Executive

LAST Saturday, February 23rd, a main lecture of the Society of Licensed Aircraft Engineers was read before members by Mr. R. E. Hardingham, O.B.E., F.R.Ae.S., M.S.L.A.E., secretary and chief executive of the Air Registration Board. He chose as his title *Some of the Responsibilities and Problems of an Airworthiness Authority*, his paper dealing with the history, constitution, duties and general policy of the A.R.B., together with the methods adopted by the Board to determine standards and investigate the flying equipment under its jurisdiction. The following is a summary of Mr. Hardingham's paper.

The A.R.B. was created as a limited company—permission being granted to omit "Limited" from the title—in 1937, to take over certain work previously carried out by the Air Ministry. The Board has no subscribed capital and must not make a profit. Its council is made up of eighteen unpaid members representing various interested parties, while the permanent staff at present number 219, of whom 127 are technical officers known as "surveyors."

The Board's primary duty is to ensure that all flying equipment over which it has authority meets the standards which it specifies. The A.R.B. is also responsible for examining engineers and certain aircrew personnel. When materials, equipment and personnel meet the A.R.B. standard, the Board is empowered to issue the appropriate licence.

Experience has shown that, if the responsibility for airworthiness matters rests—so far as possible—upon those actively engaged in the industry, results are better than if an "all-wise" authority were there to take full responsibility. This is, broadly, the A.R.B.'s policy, and it has been achieved by granting approval to suitable design and inspection organizations, the Board retaining the right of supervision.

Speaking of airworthiness rules, Mr. Hardingham said that the A.R.B. preferred to state objective requirements and leave manufacturers and operators free to comply in their most efficient manner; sometimes, however, detailed criteria had to be stipulated. The outstanding trend in civil-aircraft requirements was the replacement of arbitrary performance values with more realistic ones taking into account all the factors involved.

Internationally, the Board embodied I.C.A.O. standards into its own requirements, unless the I.C.A.O. ruling was considered uncertain or unsound. In the lecturer's opinion, the international standards frequently included far too much detail, which was felt to be a regrettable influence.

Structure-fatigue Problems

V-g recordings were of importance in estimating the maximum flight loads experienced by the aircraft, from which the proof and ultimate loads could be specified. Recent structural tests had yielded maximum-strength values varying from 50 to 150 per cent of the assessed ultimate loads; this stressed the importance of checking calculation by practical experiment; especially in view of the many new problems now encountered.

The effective life of aircraft was increasing steadily, said Mr. Hardingham, and it appeared that fatigue problems would be of ever greater importance. The application of present knowledge of fatigue was difficult; at present, the A.R.B. was laboratory-testing certain critical components taken from aircraft after varying periods of service. This process gave an immediate indication of the remaining life of the structure, and should avoid fatigue-failure in flight.

Turning to power plants, the lecturer spoke of the new field opened up by gas turbines; experience was showing that each turbojet installation had to be treated individually. Maximum jet-pipe temperatures and icing were two of the Board's chief concerns in this sphere; fuel consumption was not, however, while the comparative freedom of vibration of turbines was to be welcomed.

Power controls, which complicated a fundamental feature of aircraft—primary control—demanded extreme vigilance in order, firstly, to ensure that power output did not fail and, secondly, so to harness the potential power as to prohibit overstressing the aircraft. These aims were, at present, being sought by, in the first case, providing duplication of power sources and certain vital items and, in the second, by employing g-restrictors, cut-out and trail devices in the control circuits, and similar precautions.

Electrical services and radio were rapidly increasing in both complexity and importance; to illustrate the former characteristic, the lecturer instanced a familiar undercarriage control-circuit in which were 137 electrical units, exclusive of wiring accessories. Such services were potential fire-sources, while accessibility, freedom from high-voltage shock, and the elimination of radio interference all demanded special study.

A major section of the lecture was headed by the now established term of "crashworthiness." It could be submitted that *some* crashes were unavoidable, from which the necessity of making aircraft safer in a crash was an obvious deduction. It was possible, by heavily penalizing the design, to provide protection against violent crashes. He stressed, however, that if this were specified the A.R.B. would be acting improperly, unless operational weaknesses had first been examined; he further considered that the Board was meeting its present obligations by requiring seat- and belt-strengths to be adequate for all but the worst crash conditions, and by trying to eliminate all interior projections and obstructions. He reminded his audience that the original crash acceleration design value of 6g (since increased to 9g) catered for a fairly severe impact.

Fire-Protection Requirements

On the subject of fire prevention, Mr. Hardingham said that an overlapping of precautions was essential if complete prevention was aimed at; in this country, the "two-shot" extinguishing system was not favoured, an individual system being preferred for each power plant. The lecturer felt that work could profitably be directed towards obtaining better fire-detection; serious fires had, in the past, built up in very brief periods. In comparison with piston engines, gas turbines were, in the opinion of many experts, no safer by virtue of their use of paraffin as fuel; the lecturer disagreed upon this point, and felt paraffin to be especially safer in the crash case. Nevertheless, gas turbines should be effectively shielded by stainless-steel sheet over vital parts, within which shielding the fuel could be confined by shut-off cocks. It also appeared desirable to provide means for automatically shutting-down "buried" engines in the event of a crash.

Flight testing of aircraft now had to be carried out in temperate, tropical, night, high-altitude and icing conditions, while handling qualities in rough air were also examined. Past experience had shown the need for an aircraft to complete a minimum number of hours before certification. A proportion of this time had to be flying in which the airworthiness endurance of the type was tested under actual operational conditions. Carefully planned flight-testing could provide a wealth of useful data to the eventual operator, while eliminating many of the teething troubles.

In conclusion, the lecturer recalled that the Chief Technical Officer of the A.R.B., Mr. W. Tye, O.B.E., B.Sc., F.R.Ae.S., had recently showed that lack of airworthiness in the United Kingdom was responsible for only 9 per cent of the accidents which had occurred. This was no cause for complacency, in Mr. Hardingham's opinion, and the Board, constructors, operators and engineers would all have to continue to strive for safer flying. The issue of the Certificate of Airworthiness, although ranking of the highest importance, marked neither the beginning nor the end of the Board's work, which embraced the whole life of each aircraft.

SEARCH RADAR for CIVIL AIRCRAFT

Results Obtained from Equipment on Operational Test: A Lecture to Radio Engineers

THE application of search radar so far as it concerns civil airline operation was discussed by Mr. P. L. Stride, of the electronics division of E. K. Cole, Ltd., in his lecture to the London Section of the British Institution of Radio Engineers on February 20th. Abstracts from the paper follow.

Extensive use made of airborne radar during the late war [said the lecturer] suggested that civil aviation would be able to benefit immediately from the equipment and techniques developed. It is significant that, although limited use has been made of secondary radar devices such as Gee, beacons, etc.; only one airline has yet fitted primary radar for commercial operations.

It is believed that this delay is due, in part, to the potentially wide range of functions which this type of equipment can fulfil, and hence the difficulty of defining the characteristics of a system which will result in a real increase in safety and regularity of services without too great a penalty in terms of cost, weight and maintenance problems.

The possible functions may be divided into those that cannot be performed satisfactorily by any other method, and those that supplement existing facilities.

Examples of the first group are: (1) Detection of high ground in the flight path; (2) detection of dangerous storm centres associated with cumulo-nimbus clouds; (3) detection of other aircraft constituting a collision hazard. The second group includes: (1) Navigation by map-painting; (2) navigation in conjunction with suitable responder beacons; (3) measurement of ground speed and drift.

The relative importance placed on these various functions depends to a large extent on the sort of operations required, e.g., on those portions of overseas routes involving crossing mountain ranges or let downs in difficult country; high ground warning and map-painting might then prove a most valuable aid to navigation and the radar worth carrying for this reason alone. Similarly, for routes in tropical regions, detection of dangerous storm centres might be the primary need.

The equipment already tried arose out of a war-time requirement for the detection of dangerous cumulo-nimbus clouds by transport aircraft in Far Eastern theatres.

Early trials using American equipment were carried out in 1945 and were followed by further trials in 1946-47 with a system built by the Telecommunications Research Establishment. The results of the early trials were sufficiently encouraging to warrant the development of a fully engineered system suitable for use in civil aircraft.

Throughout this work, a satisfactory performance in respect of cloud warning, terrain clearance and, to a lesser extent, map-painting, has been the main consideration, and complications leading only to a limited increase in utility have been avoided.

Cloud Characteristics

One purpose of the equipment is to detect turbulent cumulo-nimbus clouds as distinct from harmless rain-bearing types. Fortunately, cumulo-nimbus clouds are characterized by large water droplets within the cloud and, at a later stage in their development, by a concentrated fall of such droplets. The theory indicates that scattering increases rapidly with drop size, hence the probability of differentiating between dangerous and non-dangerous cloud is good, providing that the wave-length chosen is long enough to preclude large echoes from fine droplet types. The path attenuation is also important if the desired target is hidden in other heavy cloud and when it is desired to see the far edge of a storm area. Taking all these factors into account leads to the conclusion that a wavelength in the region of 5-6 cm is the most favourable. In practice, the choice is between either 10 cm or 3 cm because of the availability of components for these wavebands. For an aircraft installation where size and weight are important there are obvious advantages in using 3 cm since, for a given beam width, the mirror aperture is approximately one-third of that required at 10 cm.

The choice of beam width is influenced by several conflicting factors. A storm cloud may only be one or two miles wide, so that at ranges in the region of 50 miles the angle subtended at the radar is only two or three degrees. It is also essential that the display is not confused and obscured by unwanted ground returns. Both of these factors indicate the desirability of a very narrow beam. However, for map painting a wider beam is required to give good horizontal coverage. A conical beam with an included angle of 6 deg and capable of being tilted in elevation was used during early trials and found to be a satisfactory compromise. At 3 cm a beam of this width is given by an 18-in paraboloid, a reasonably convenient size for an aircraft nose installation.

The cloud warning and terrain clearance applications of the equipment do not demand a large angle of scan; 150 deg swept once a second is considered reasonable, although something approaching 360 deg is desirable for map painting. Wide angles of scan are difficult to provide without a ventral installation, a feature viewed with little enthusiasm by aircraft constructors. It must be remembered also that the scanner and radome projection would be quite large owing to the necessity for looking dead ahead for cloud warning. Accordingly, a nose installation using a scan angle of ± 75 deg was adopted.

The operational trials of the equipment were carried out by B.O.A.C. on behalf of the M.C.A. These trials were intended to assess the practical utility of the equipment for cloud detection and high ground avoidance, rather than to provide any further scientific data on radar echoes from clouds. The first trials period was devoted primarily to cloud work and was carried out in the Singapore-Hong Kong area using a Hythe flying boat, while the second period was used to investigate the high ground warning application in Europe with a Viking aircraft.

During all operations the aircraft was flown under blind flying conditions.

Provision was made for simultaneous photography of a second indicator display and the forward view from the aircraft, together with the readings of an accelerometer, altimeter, air speed indicator and clock.

Results of Tests

Theoretical predictions and early trial results were amply confirmed by the detection of the larger cumulo-nimbus clouds at the maximum range of 40 miles. In general, the range of detection was dependent on the vertical depth of the cloud and most of those with depths exceeding 25,000ft gave responses at maximum range. The greatest vertical depth measured was about 40,000ft.

Although a number of penetrations were made no reliable correlation was found between turbulence and range of detection or height of the cloud. However, it appears certain that if all radar response areas are regarded as potentially dangerous and avoided, then what would visually be classed as a forbidding cloud formation can be negotiated with safety and comfort. The lateral diversions involved are much smaller than would be necessary to avoid a large cloud bank completely. No responses were obtained from other types of cloud such as stratus or strato-cumulus.

A thorough investigation of the high ground warning and terrain clearance capabilities of the system showed that avoidance by the safety circle technique gave the most satisfactory results.

Tests of the method on a large number of different reflecting media such as level terrain, cliffs, mountains and ships, did not produce errors in indicated clearance height of greater than about 500ft providing that the inner cut-off range used was not greater than about 6-10 miles. These results were obtained at clearance heights in the region of 2,000-5,000ft. At the lower clearance heights it was generally necessary to reduce the warning range in order to maintain a well-defined inner edge of the response. This effect was particularly pronounced over undulating ground.

During the course of trials a considerable amount of *en route* flying provided ample opportunities for assessing the utility of the map-painting facility. As would be expected, from previous experience, bold features, such as coastlines, large rivers and isolated regions of high ground, provided easily recognizable targets, and under these conditions it was possible to fix the position of the aircraft with greater accuracy and speed than by normal methods.

Large sections of coastal routes such as Karachi-Bahrein were flown at night using the radar as the prime navigational aid, and approaches to marine airports were particularly easy.

A land-locked harbour surrounded by high ground, such as Hong Kong, provides a very difficult approach problem under bad weather conditions. Using the radar display it was found possible to negotiate the entrances and fly within the harbour area well below the surrounding high ground.

Concluding his paper, Mr. Stride said, "It is considered that the results so far obtained with the equipment described indicate that airborne radar can be of great value in civil aircraft operations. Its use should lead to a material reduction in the number of flights cancelled or abandoned due to unfavourable weather conditions, particularly in tropical regions, and to the virtual elimination of collisions with high ground."

NAVIGATION in WAR

A Specialist Reviews Pros and Cons of Various Navaids for Service Use

THE choice of navigation systems for use in military aircraft was the subject of a lecture given in London on Friday last, February 22nd, before members of the Institute of Navigation. The paper—a summary of which follows—was the work of S/L. D. Bower.

The lecturer began by saying that it was usual to divide the military navigation problem into three phases corresponding to successive stages in the progress of a sortie. *The en-route phase* covered the flight to and from the target area and fundamentally demanded only the ability to reach that target by the prescribed route, but more stringent requirements, such as those of highly accurate track- and time-keeping, might be imposed by tactical considerations. *The tactical phase* covered navigation in the target area up to the point of weapon release; the precise nature of the task was determined by weapon and target characteristics. Ability to locate the target accurately by non-visual methods was highly desirable at all times and became increasingly important as aircraft speeds and operating heights increased. *The terminal phase* embraced blind approach and rapid-landing problems similar to those of civil aviation but in a more acute form, since tactical considerations restricted the distance from base at which traffic marshalling procedures could commence to operate, and peak traffic densities were the rule rather than the exception.

The value of a military navigation system must be judged by its contribution to the overall operational effectiveness of the air weapon. Economic considerations were important and the optimum system was that which produced the maximum returns in operational effectiveness for a given expenditure of development and production effort. This demanded careful analysis to determine the true nature of the navigation problem and the relative importance of the various parameters in their end effects. Theoretical predictions were insufficient, and properly controlled flight trials were essential; to be valid, these should be carried out under a close approximation to actual operational conditions. In some cases it was impossible to create such conditions in peace-time and reliance must be placed on past experience of previous navigation systems in war; but even this was of doubtful value when we were faced with radical changes in aircraft performance and weapon characteristics.

The selected system must, therefore, be flexible in order to cater for conditions unforeseen or imperfectly foreseen during the planning stage. Flexibility was a highly desirable quality in any case, since the navigation task was strongly influenced by tactical requirements that were themselves influenced by enemy reactions and thus subject to more or less continual change. The piecemeal development of the German night-fighter navigation system to meet the tactical conditions imposed by Bomber Command provided a good illustration of the importance of this aspect.

The mobility of air forces must not be restricted by their navigation aids and any ground installations must be capable of rapid redeployment in a new theatre of operations. Radio aids were the chief offenders in this respect, hence the trend toward navigation systems of the self-contained type, which did not depend on co-operation with a ground station; but it was not always easy to accommodate these in small aircraft and they sometimes involved an unacceptable loss in accuracy. In cases where there was no alternative to the use of a radio aid—e.g., in the terminal navigation phase—mobility could be assisted by avoiding types which were site-sensitive, involved extensive site preparation, or the preparation of special lattice-charts.

The need for navigation aids to be secure against enemy use or interference was amply demonstrated, said the lecturer, by the fate of the German Knickebein beam system in the last war. If applied rigorously, this consideration would preclude completely the military use of radio aids; account, however, should be taken not only of the technical possibility of an enemy being able to interfere with them but also of the probability of his attempting to do so. That risk was higher, and the objections to radio aids greater, in the *en route* and tactical phases of navigation.

The need for reliability was stressed by the fact that the ill-effects of poor serviceability could be experienced in concentrated form during a single operation. An 80 per cent average reliability in a target-locating device meant, for example, that 20 per cent of the bomber force engaged in a particular attack might fail to deliver their bombs in the proper place. For this reason the wisdom of demanding extreme accuracy at the expense of increased complexity and reduced reliability required very careful examination.

A study of the likely theatre of operation, continued the lecturer, should always precede the final choice of navigation system. The availability of suitable bases in friendly hands determined the practicability of multi-station fixing aids such as Loran, and there were strong arguments in favour of the single-sited RØ system, particularly overseas. Terrain and the quality of mapping influenced the value of aids of the H2S type, where the accuracy of fixing was proportional to the availability of suitable radar landmarks. The size and shape of base areas in relation to the aircraft population affected the selection of terminal navigation aids; very high traffic densities were likely to occur, and could lead to radio frequency congestion problems and the saturation of aids with limited handling capacity.

Conflicting Requirements

Aircraft installation problems favoured aids of the multi-purpose type and, because the tactical navigation phase was the most exacting, there were some arguments in favour of satisfying this requirement first and then adapting the solution to cover the *en route* and terminal phases. There was, however, a danger that this procedure may be accompanied by a loss in flexibility. The demands of radio aids for favourable positions for suppressed aerials often conflicted with the requirements of other electronic equipment and armament; a possible solution would be a means of enabling several equipments to share a common aerial, but this would tend to intensify problems of frequency congestion. Where space was very restricted there was a temptation to reject the bulky, self-contained type of navigation system in favour of radio aids involving dependence on ground stations; in such cases it was for consideration whether the interests of operational effectiveness were better served by adopting the former and accepting a slight reduction in aircraft performance.

Possibly the most useful criterion of all for the selection of a navigation system was the principle that one second-class aid in the aeroplane was worth half a dozen perfect solutions in the laboratory. This was why the arguments for a particular device should always be accompanied by an estimate of the time-scale for development and production—an estimate which was realistic in the first instance and was adhered to subsequently.

AIRFIELD-LIGHTING BRITISH STANDARD

A FURTHER revision has recently been issued by the British Standards Institution to B.S. 1332 : 1952, which is entitled *Guide to Civil Land Aerodrome Lighting*. As well as providing a description of the probable future requirements for airfield lighting equipment to give adequate assistance to pilots under all operating conditions, the guide includes information on beacons, approach, threshold, runway, taxiway, obstruction and boundary lights, and in addition deals with floodlights, traction indicators, ground-traffic signalling lights and portable and emergency lighting. Copies of the Standard are obtainable at 3s. including postage, from the British Standards Institution Sales Department, 24 Victoria Street, London S.W.1.

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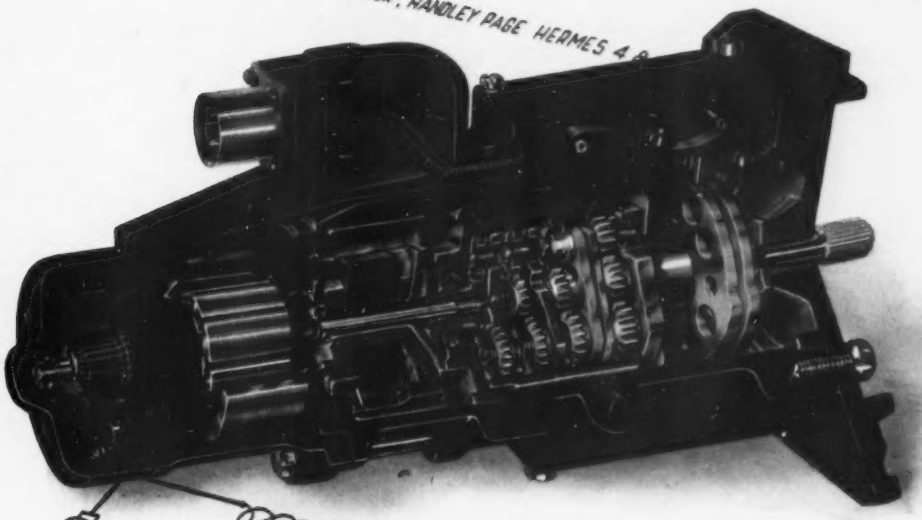

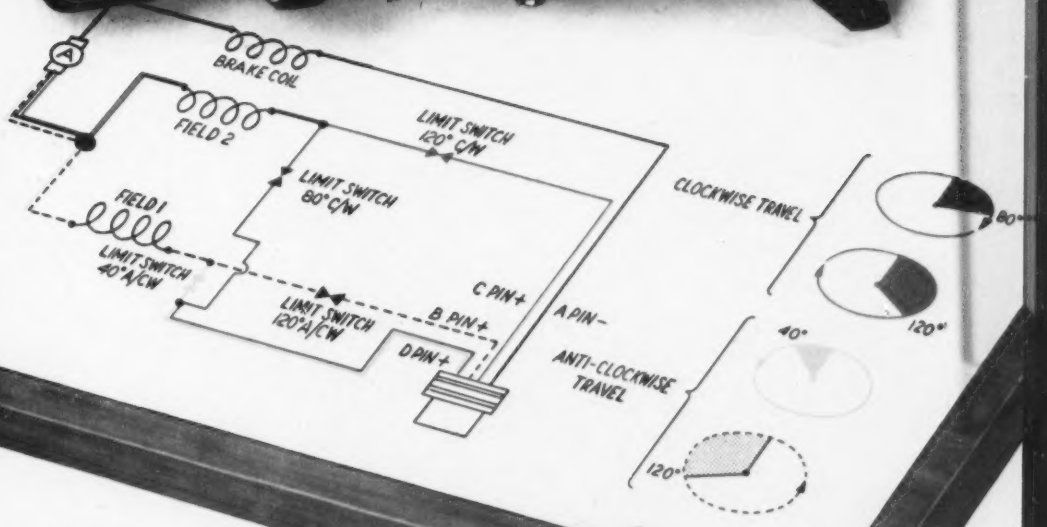

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POWER STEERING

R.Ae.S. Members, at Hull, Discuss the Paper by Hancock and Person

WHEN a main R.Ae.S. lecture, *Power Steering for Aircraft* (summarized in our last week's issue) was delivered before the Brough Branch in Hull on Thursday evening, February 21st, the authors, Messrs. K. G. Hancock and P. Person, each read sections, and answered numerous questions arising during the lively discussion. Mr. George Dowty was in the chair.

MR. H. G. CONWAY (British Messier) opened the discussion. He had hoped to hear more about pilot controls for steering—a separate steering wheel, a control coupled to the aileron wheel, or perhaps in some aircraft one coupled to the rudder. Foot-operated steering de-clutched for flight and re-engaged on landing could cause some difficult moments during change-over. Regarding shimmy damping, he felt that the coupled-wheel system was the best, i.e. stop the shimmy on the ground. He did not believe shimmy could occur with coupled wheels, although the whole nosewheel structure might oscillate. He referred also to the one-tyre-deflated case, about which the lecturers had said a good deal. This was an emergency case and might be accepted as such, and if shimmy did occur it was unfortunate but not disastrous. In fact, in practice after first touch-down the one wheel ran along a few degrees yawed.

In reply to Mr. Conway, the lecturers said that they had seen a film indicating clearly that shimmy could occur with coupled wheels. Coupled wheels placed a limit on the maximum steering torque which could be employed. The one-tyre-deflated case was mandatory and thus had to be provided for.

MR. A. E. ELLISON (English Electric) was suspicious of hydraulic anti-shimmy systems, and agreed with Mr. Conway that coupled wheels were the correct solution. He spoke of the importance of sensitivity in hand-steering. This was specially necessary at high speed on the runway. At low speeds it was not so important because there was time to apply judgment. In answer, it was mentioned that caster axis friction would help to guard against shimmy if hydraulic damping failed.

MR. R. CUSSONS (Dowty) commented on the size of motor needed in relationship to the one-tyre-deflated case. Referring to the table of comparison of gross steering torques (printed last week) amplification of which was requested, the authors said that the first three aircraft concerned were early types and their figures today were regarded as low.

Another questioner (Blackburn and General Aircraft) thought that troubles of the one-tyre-deflated case could be forgotten if pneumatic nosewheel tyres could be abandoned. The lecturers answered that they did not think that the pneumatic cornering qualities could yet be reproduced with solid tyres.

Other speakers said that early problems were those brought by the inception of nosewheels and were not specifically of nosewheel steering. More practical information was needed about tyres. An addition to the list of reasons for nosewheel steering was that differential braking often caused pitching, which was disconcerting to passengers. Aircraft inertia, which had to be overcome, was mentioned in connection with sensitivity, and it was also pointed out that too powerful steering led to heavy tyre wear.

The lecturers had asked for pilots' views, and MR. H. N. BAILEY (Rolls-Royce) mentioned disadvantages of differential steering, fuel consumption being one of them, especially with jets, but, he added, with small and slow movements on the ground, differential use of engines had some distinct advantages. He went on to say that because of over-sensitivity at high speeds, a DC-4 he had flown needed considerable practice on the part of the pilot for correct handling of the nosewheel steering. Later he mentioned the payload advantage to be gained from nosewheel steering in helping to meet the engine-cut case on take-off.

Before Mr. N. E. Rowe, R.Ae.S. Branches secretary, concluded the discussion Mr. Conway rose again to state categorically that coupled wheels, which, incidentally, could be made lighter than others, could not shimmy if adequate separation was arranged. He added that he felt power steering had been made to seem too difficult, whereas it was one of the easiest of hydraulic problems. This confirmed an earlier remark of a visiting Editor that "mountains had been made out of nosewheels."

MR. N. E. ROWE expressed the feeling of everyone present when he spoke of the lecturers' courage in presenting their paper, the first ever to be delivered on the subject. He pointed out, rightly, that much of the discussion had centred upon shimmy damping rather than upon power steering. He was very interested in the suggestion of solid tyres, and also mentioned the trend towards very high pressure in pneumatic tyres. He agreed that sensitivity in steering needed to be considered mainly at high speeds. Mr. Rowe also wondered how very low temperatures would affect sensitivity in view of the employment of very small valves.

MR. G. E. PETTY, Blackburn and General Aircraft, and R.Ae.S. Brough Branch chairman (since 1921), rounded off the meeting with thanks, and then, together with other officials and a number of visitors, went on to the Royal Station Hotel for dinner. Among those present were Mr. George Dowty, vice-chairman, R.Ae.S. (Major Halford, the president, has, unhappily, been ill for some time); Mr. E. Turner, director, Blackburn and General Aircraft; Dr. A. Ballantyne, R.Ae.S. secretary; Mr. F. A. Wilkinson, Brough Branch secretary; and G/C. E. A. Warfield, the C.O. of R.A.F. Station, Driffield. A tribute was paid at dinner to the long association with, and support for, the Royal Aeronautical Society of Mr. Robert Blackburn (at present abroad), who first became a member of the Society in 1911.

Award to Dr. Roxbee Cox

THE Institution of Mechanical Engineers has awarded the James Clayton Prize for 1951, amounting to £1,550, to Dr. H. Roxbee Cox, Ph.D., D.I.C., B.Sc.(Eng.), M.I.Mech.E., F.R.Ae.S., "for his contributions to engineering science and practice, particularly in the fields of aeronautics, power generation and fuel utilization, communicated in part in a Thomas Hawksley lecture to the Institution in November, 1951."

The James Clayton Prize derives from a fund established by the late Mr. James Clayton, who was a member of the Institution and chief engineer of Courtaulds, Ltd. The prize was first awarded for the year 1945, when the recipient was A. Cdre. (now Sir Frank) Whittle, by reason of his great pioneer work in the development of jet propulsion.

The prize, accompanied by a certificate, was handed to Dr. Roxbee Cox by the Institution's president, Mr. A. C. Hartley, C.B.E., B.Sc.(Eng.), M.I.Mech.E., at a general meeting of the Institution on February 15th. On the same occasion the Thomas Hawksley Gold Medal, accompanied by a premium of £25, was presented to Mr. J. L. Norton, A.M.I.Mech.E., for his paper on *The Design and Development of the Twin Centaurus Power Plant for the Bristol Brabazon.*

S.B.A.C on the Defence Statement

FOLLOWING the publication of last week's White Paper on defence (see page 232), the Society of British Aircraft Constructors issued a comment in the following terms :—

"Today's Statement on Defence 1952 contains certain estimates of manpower required for the Aircraft Industry, which, when compared with earlier official estimates, may be misleading.

"The Statement on Defence says (page 10) that : 'Before the programme started the labour force in the Aircraft Industry was about 150,000; it is now 177,000, and a further 50,000 will be required by March, 1953.' It is natural to compare this with the Economic Survey for 1951 (page 10) which stated that : 'About 175,000 additional workers are estimated to be required for aircraft factories and Royal Ordnance factories in the next two years.'

"The Statement on Defence does not, however, give any explicit confirmation that the basis of the manpower figures is the same as before, and the Society advises caution in making comparisons."

A Cellon Appointment . . .

Mr. W. F. Wilson, who has been appointed to the board of Cellon, Ltd. During 25 years with these well known makers of finishes, he has successively been chief chemist (1929-1943), technical development manager (1943-1950) and technical manager; he will continue in the last-named capacity. Another recent Cellon appointment is that of Mr. F. I. Smith (for many years in charge of the accounts department) as assistant secretary.

ELIZABETHAN AGE: This new air-to-air view of R.M.A. "Elizabethan" shows to advantage the elegant lines of the flag-ship of the new B.E.A. Ambassador fleet. Some delivery details are given in the first news item on this page.

CIVIL AVIATION

B.E.A.'S ELIZABETHAN PLANS

SO far, B.E.A. has taken delivery, on loan, of four Elizabethan-class Ambassadors: G-ALZP, *Sir Richard Grenville*; G-ALZR, *Sir Walter Raleigh*; G-ALZS, *William Shakespeare*; and G-ALZT, *Sir John Hawkins*. They are being used for aircrew training; but, by the time this issue appears, one or more of them may be operating on services between London and Paris.

The Ambassadors will at first be integrated with the Viking flights, and a maximum of 27 revenue passengers will be carried. In mid-March the Elizabethans are expected to enter regular scheduled operation on the London-Paris route.

NEWARK ACCIDENT INVESTIGATION

AS a result of a preliminary inquiry into the third recent crash at Newark Airport, New Jersey, the C.A.A. has ordered immediate modification of the electrical wiring system controlling the reversible-pitch airscrews of all DC-6s and Convair 240s. The Administration has stressed, however, that it is not intended to ground either type.

The investigation indicated that the starboard inner airscrew of the DC-6 involved was in reverse pitch, whilst the starboard outer was fully feathered. This phenomenal occurrence is believed to have caused the accident.

It appears that the new re-wiring instructions issued by the C.A.A. will make it impossible to use reverse pitch for reducing the length of landing runs. The airscrew control leads are to be removed from their present position and run separately, where they can be more easily checked and serviced.

United Aircraft Corporation, in an independent statement, pointed out that various components were still being studied and that all data so far obtained must necessarily be considered as tentative. The Corporation stated that although there was evidence of one airscrew being in reverse pitch, there was no indication of the airscrews themselves being defective. Investigation of all electrical systems, the fuel system, and other components was continuing.

THE DOUBTS OF C. R. SMITH

THE president of American Airlines, Mr. C. R. Smith, has expressed some views on gas-turbine powered transports. He told an *American Aviation* interviewer that he did not think much of conversions and that it was better to build a machine specially in order to get the utmost out of a turboprop or turbojet. The conversion of Convair-liners, DC-6s or Constellations, Mr. Smith thought, was too expensive when viewed against the increased performance obtained. He considered the cost of conversion of a Constellation or DC-6 would be anywhere between $500,000 and $800,000.

"Boeing, Douglas and Lockheed," he said, "have three basic conceptions of jet transport design. The Boeing has engines hung in pods on the wings, the Douglas has them sticking out in front of the wings and the Lockheed concept puts them back in the line of thrust somewhere in the back end and the bottom of the fuselage. All three cannot be right; the air transport industry had better work with the manufacturers to determine the best design, and not go off in three directions. Nearly anybody would guess that the development of a jet transport would cost about $20,000,000."

Mr. Smith went on to say that he did not think that any British jet transports would be seen in American operation; that the economy of the British jet was not such that any money could be made with it; and that U.S. jets, when they were available, would be "considerably more modern and efficient than the British 'planes of the Comet type."

There would be no widespread use of jets in U.S. domestic operation until there were substantial improvements in operating economy—that should come within the next five years, and the economy should be reasonable by 1958. Reciprocating-engine transports would remain useful for many years and that it was too early to predict that they would be supplanted by jet transports, at any date in the future; their ability to stay in operation would depend largely on the comparison of operational economy. He thought, however, that the DC-7 would be the last of the big transports with piston engines.

B.O.A.C.'S AIRCREW VACANCIES

FOR the first time in several years, B.O.A.C. has a substantial number—50 or more—of pilot vacancies. Men below the age of 35, preferably in their early twenties, are required, the minimum qualifications being the possession of a Commercial Pilots' Licence and an Instrument Rating.

Successful candidates will join the Corporation as second officers, receiving a salary of between £815 and £935 a year, and after a period as second officers will become first officers with a starting salary of £1,035. In exceptional cases, applicants may enter direct as first officers.

B.O.A.C. says that the vacancies have arisen as a result of the retirement of a number of pilots, forthcoming fleet expansion and the introduction of new types of aircraft.

EIGHT INTO FOUR

A CHANGE in the pattern of the U.S. air-transport industry will mean fewer but stronger companies if four mergers now pending are approved by the airlines' stockholders and the C.A.B. The proposed mergers are of Braniff International Airways with Mid-Continent Airlines; Capital Airlines with Northwest Airlines; Colonial Airlines with National Airlines; and Delta Air Lines with Northeast Airlines.

The Braniff Mid-Continent merger would give the new combine (which would retain the name Braniff) a fleet of 58 DC-3, DC-4, DC-6 and Convair 240 aircraft, serving 35 cities in 12 states. During 1951, Braniff gave Mid-Continent $334,857 worth of interline business and received $270,113 worth from Mid-Continent.

Capital and Northwest would combine to employ about 10,000 people and over 100 aircraft comprising Stratocruisers, Constellations, DC-4s, DC-3s and Super-DC-3s. The new concern would be called Northwest-Capital Airlines and operate 26,000 miles of routes.

NOISE AT LONDON AIRPORT

FOLLOWING recent discussions arising from local residents' complaints about noise in the vicinity of major airports, the M.C.A. has started a series of investigations into the problem of the sound created by engines running-up at London Airport. Temporary screens of corrugated asbestos are to be built to test their effectiveness in reducing the noise. These screens will form a large bay and different heights and widths will be experimented with.

The test area will be monitored by a sound-analyser, manufactured by Standard Telephones and Cables, and embodying an ultra-sensitive microphone. This instrument gives readings in

PROGRESS

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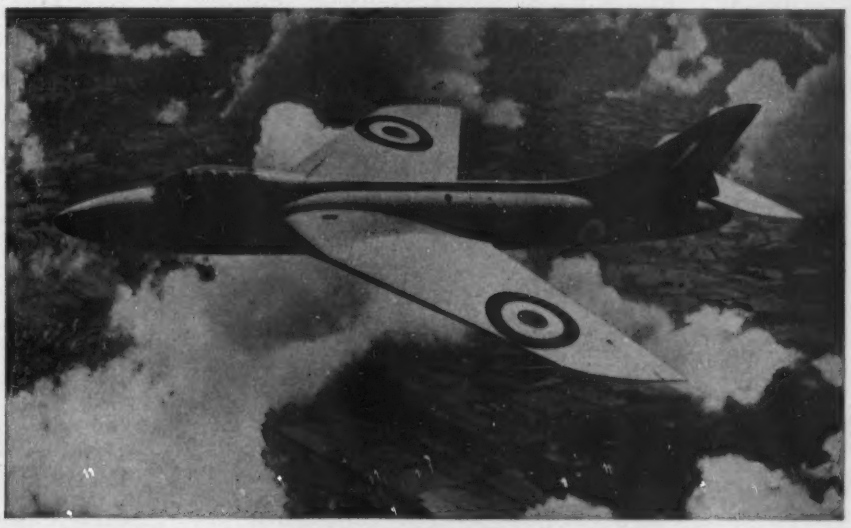

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CIVIL AVIATION . . .

terms of both overall noise and individual frequency bands, the noise-level being checked in eight different octave-bands, each set of measurements including about 100 sound levels. Measurements are being made at varying distances and in differing weather conditions, the microphone being mounted on a tripod and set in a wire cage covered with fine muslin to reduce the wind-noise.

Experiments have also been made to see how far engine-sound penetrates trees, and whether a plantation around the airfield would effectively reduce the noise. (Presumably a suitably "self-stunting" variety would be chosen.) The running-up of engines in hangars where possible, rather than in the open, is also being considered.

The problem is also being tackled independently from the engine-designer's point of view. Here, of course, the difficulties are well known, and are likely to be further complicated when commercial jet aircraft go into regular service. Incidentally, some remarkable results have been achieved by modification of Argonaut exhaust systems, as recorded on page 242 of this issue. Though designed primarily for the benefit of passengers, these modifications have also had the effect of reducing the noise-level as heard by those outside the aircraft.

The screen tests at London Airport are still in a very early stage, and no results are yet available.

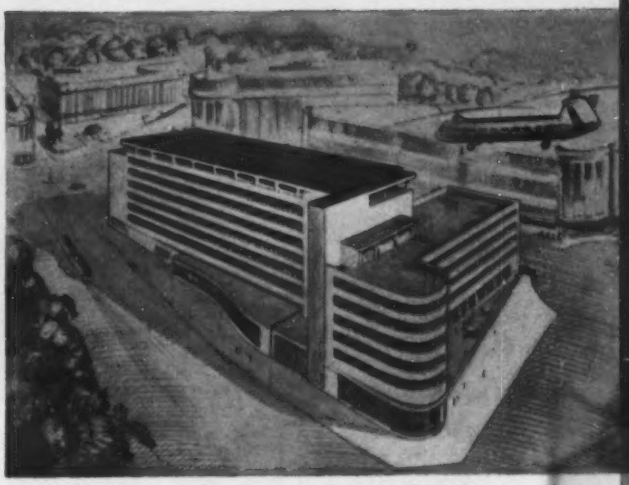
A.O.A. MEETS M.C.A.

THE Ministry of Civil Aviation, it appears, now has under consideration a scheme by which privately owned airfields lacking air-traffic controllers will be able to appoint suitable individuals after official approval. The appointment having been confirmed, the existence of the qualified A.T.C.O. at the particular airfield would be mentioned in *The Air Pilot*.

The existence of the scheme was briefly mentioned by Sir Alfred Le Maitre, K.B.E., C.B., M.C., Controller of Ground Services, M.C.A., at last week's annual dinner of the Aerodrome Owners' Association. In his speech (a characteristically entertaining one which began "Fellow aerodrome-owners——" and referred to "the present position as seen from the servants' hall") Sir Alfred also remarked that he had been to Southend Airport to see "the poor man's G.C.A." (i.e. the Ekco radar approach-aid) and had been impressed by its possibilities: the Ministry now hoped to try it, with certain modifications, on three or four of their own aerodromes.

Other speakers mostly struck what might be called a note of very cautious optimism. Air Chief Marshal Sir Frederick Bowhill, G.B.E., K.C.B., C.M.G., D.S.O., deputizing at short notice for the Minister, praised the A.O.A.'s part in supplying bases for "the Merchant Navy of the air." The chairman of the A.O.A.'s executive committee, Mr. A. Graham Douglas, D.F.C., said that the Association's membership, which had dropped by only about a quarter since the over-optimistic days immediately after the war, now gave signs of increasing again; helicopters might soon bring new business for aerodrome owners, for people were now beginning to realize that roof-top operation was largely wishful thinking.

Ald. Rhodes W. Marshall ("two million people use Britain's airports in a year—that's less than one-third of the visitors we get at Blackpool") put in some forthright North-country speaking; Mr. Charles M. Newton, an A.O.A. past chairman, enlarged on the helicopter theme, incidentally taking the opportunity of telling his M.C.A. guests what he thought about "that awful official word 'airstop' "; and Mr. Eric Rylands of Lancashire Aircraft Corporation had something to say about the new service charge, adding "North Country folk leave half a crown on the mantelpiece for when they return from Wakes week: now, with the £25 travel allowance, we shall find people leaving five bob at Northolt so they can pay the taxi on their return."



SABENA'S NEW TERMINAL in Brussels, to be ready next year, includes arrival and departure halls, a freight reception and enquiry centre, a bonded warehouse and a large car park, in addition to housing the booking system for the entire network. There is an underground connection between the terminal building and the Brussels Central Station.

LOOK, DON'T ASK: Aer Lingus has now installed, at Dublin Airport, a flight arrival indicator which it is hoped will ease the work of the enquiry-counter staff. The messages are printed on rollers similar to those used on buses, but they are operated by remote control. Similar installations at London and Northolt Airports are long overdue.

BREVITIES

THE European-Mediterranean Regional Air Navigation Meeting of I.C.A.O. opened in Paris on February 26th. Twenty-six nations met to discuss common navigational, meteorological, air traffic control and communication problems affecting civil aviation in the region, taking into account the greatly increased military activities.

* * *

Air India International has announced an order for two Lockheed Super-Constellations for use on its trunk routes. The present fleet consists of four L-749 Constellations.

* * *

New cotton-spraying contracts for the treatment of over a quarter of a million acres have been obtained in the Sudan by Pest Control, Ltd., of Cambridge. More than half this total acreage will be sprayed from the air by a combined fleet of Hiller helicopters and Austers, sent out from this country.

* * *

Air Transport (Charter) (C.I.), Ltd., announce the appointment of Mr. F. G. Noble as general manager. This post was formerly occupied by Mr. J. Wright, who lost his life while flying from Ringway to Belfast last March. Mr. Noble, who has been with the company for some eight years, was previously its commercial manager.

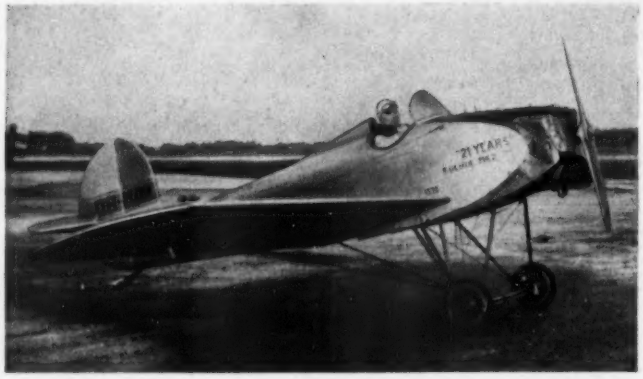
* * *

The future of Cowes Airport, which was recently advertised for sale, was discussed in the Isle of Wight Development Plan, recently laid before the County Council. The M.C.A. has intimated that it may withdraw the airport licence in certain circumstances, e.g. if building development takes place within 600ft of Three Gates Road on the northern boundary of the aerodrome.

* * *

A combined air-sea round journey between New York and Nassau is now offered jointly to passengers by B.O.A.C. and the Incres Nassau Shipping Line. Passengers have the option of going to Nassau by sea and returning to New York by air, or *vice versa*, the combined fare being booked on one ticket. B.O.A.C. makes daily flights between New York and Nassau, six weekly by Stratocruiser and once weekly by Constellation. The Incres Line has a service once a week in each direction with the s.s. *Nassau*. Similar agreements are held by B.O.A.C. with three other shipping lines in the Western Hemisphere.

FROM THE CLUBS



BETTER LATE . . .: Construction of this Finnish ultra-light began in 1930; as related on this page, it has now culminated in a successful first flight in the hands of its builder, Mikko Kuhlia, at Helsinki.

A GOVERNMENT fund to encourage private flying, with a contribution of 6d out of the 9d per gallon tax on aviation spirit, has been suggested by the Aero Club of South Africa. If the proposal were accepted, it might yield about £20,000 a year. According to Col. A. M. Broad, chairman of the South African Aero Club, it has been well received and is now being considered by the Treasury.

Private flying in South Africa, said Col. Broad, was in a desperate state because the clubs had been "shockingly neglected" since the war. They were not supplying potential aircrew as they did before the war because flying as a sport or hobby was far beyond the means of the ordinary man.

Broad said that if positive action were not taken quickly, he foresaw that in four or five years' time the Union would have to import air and ground crews.

DESPITE adverse weather, the London Aeroplane Club's January flying totalled 85 hr 10 min. During the month, also, no fewer than sixteen new pupils joined, two members carried out their first solos and two others obtained their P.P.Ls. Membership amounts to 226 and the club fleet consists of two Tiger Moths, one Chipmunk and one Moth Minor (a coupé version). Mr. McBeath is now chief instructor in place of Mr. Cather, who recently went to Canada, and three part-time instructors are on duty at week-ends.

Three club fixtures have so far been planned; the first on April 6th, will be the annual general meeting at 11.30 a.m., before which a dawn patrol is to take place. Defending aircraft will patrol between 9 and 9.30 a.m. and, as usual, attackers penetrating the defences without having their registrations taken will qualify for free breakfasts. The second event is an "at home" at Panshanger on Saturday, June 14th. This has been organized jointly by the L.A.C., Vintage Aeroplane Club and Herts Auto and Aero Club. Various competitions and display items will be rounded off by a dance in the evening. The third event, of a purely social nature, is the midsummer dance, to be held at Hatfield on June 27th.

FROM Finland comes news of the first flight of the ultra-light illustrated above. Construction began as long ago as 1930, but various set-backs, including two uncomfortably close wars, were responsible for the lapse of 21 years before the machine was airborne in the hands of its builder, Mikko Kuhlia. Designated the Kuhlia Mk II, this rather improbable-looking machine is powered by a 1,100 c.c. Anzani vee twin. It is said to have a cruising speed of approximately 80 m.p.h., stalling speed of 48 m.p.h. and a range of about 242 statute miles. All-up weight is 662 lb and wing-loading 6.65 lb/sq ft.

DURING the month of January the Strathtay Aero Club logged a total of 93 hr 25 min, a figure which compares very favourably with that for the corresponding period last year, in spite of severe weather conditions experienced. Of this total, 89 hr were completed in two Tiger Moths when temperatures were as low as 32 deg F. Two pupils made their first solos and one completed requirements for his Private Pilots' Licence

THE R.Ae.C. AVIATORS' CERTIFICATE

A Classic Document becomes of Sentimental Value Only: New P.P.L. Application System

AS from March 24th next, potential private pilots will have their "paper load" reduced by one document, for after that date the Royal Aero Club Aviators' Certificate will cease to be a desirable preliminary to the obtaining of a Private Pilots' Licence. For many years the Certificate has not been compulsory, but its possession provides the easiest path to obtaining a P.P.L., for the R.Ae.C. certification is accepted by the M.C.A. as evidence of an applicant's ability to fly. R.Ae.C. official observers in various parts of the country are responsible for supplying proof that the applicant has passed the necessary tests.

Names of those who have qualified for Aviators' Certificates have long been a periodical feature in *Flight*, which has published them in its capacity of official organ of the R.Ae.C.

The new arrangement is the result of a review by the R.Ae.C. in collaboration with the M.C.A. It has been agreed that the certificate is now only of historic value.

The first R.Ae.C. Aviators' Certificate was issued on March 8th, 1910, to J. T. C. Moore-Brabazon (now Lord Brabazon of Tara, the president of the club); nearly 28,000 have since been awarded. From 1910 to 1920 the Aviators' Certificate was the only civil recognition of a pilot's ability to fly. In 1920 the Air Ministry (which then controlled civil aviation in this country) issued the Pilots' "A" Licence, which was superseded in 1949 by the Private Pilots' Licence; but the Aviators' Certificate was still accepted as proof of the applicant's flying competency.

The R.Ae.C. will continue to appoint official observers to take P.P.L. applicants through their flying and technical examinations. In a circular to its observers, the Club sets out the procedure which applicants are to follow with effect from March 24th. Principal points are :—

(1) Practical flying tests will be carried out by official observers as at present, but after satisfactory completion of these tests the observer will certify on the Private Pilots' Licence application form (M.C.A. Form 603 Revised) and not on the Aviators' Certificate form.

(2) Technical examinations will be conducted without charge, the observers certifying the results on the answer paper (M.C.A. Form 603 Revised, Part II).

(3) Fees charged by R.Ae.C. official observers will remain as at present, i.e., £1 1s. for the practical flying tests and 5s. for the technical examination.

(4) The completed papers, together with photographs, log-book (when necessary) and a remittance of 5s. should be sent *direct* to the Licensing Department, Ministry of Civil Aviation, Ariel House, Theobalds Road, London W.C.1., and not to the R.Ae.C.

Many people, of course, place a sentimental value on the Certificate. Recognizing this, the Club has arranged for Certificates to remain available to those desiring them. Reversing the former process, therefore, the qualification for a certificate is the holding of a P.P.L. Applicants should give the details and number of their P.P.L. to the Royal Aero Club, Aviation Centre, at Londonderry House, Park Lane, London, W.1., enclosing the requisite fee of 15s.

SERVICE AVIATION

Royal Air Force and Naval Aviation News

KEEPING THE PEACE: An R.A.F. Auster A.O.P. shortly after take-off from Asmara, Eritrea, airfield, which is 7,600ft above sea level. The Austers are used in Eritrea to keep watch on the "Shifta" terrorists who at one time were causing havoc in outlying villages. The combination of air and ground forces has brought security to the country.

N.A.T.O. Channel Commands

IT has been announced that Admiral Sir Arthur Power is to be the first Allied C-in-C. Channel, and that Air Marshal A. C. Stevens is to be the Air Commander-in-Chief. These appointments follow measures recently agreed by the North Atlantic Treaty Nations for an Allied naval and maritime-air command of an area embracing the Channel and the southern portion of the North Sea.

Sir Arthur Power is primarily a gunnery expert but has had considerable carrier experience. At one time he was in command of the *Ark Royal*. He is at present C-in-C. Portsmouth.

Air Marshal Stevens has been A.O.C-in-C. Coastal Command for the past eight months and has had very considerable experience in maritime-air warfare. Prior to taking over Coastal Command he was S.A.S.O. there, and during the war was Director of Operations (Naval Co-operation) at the Air Ministry. He has also been S.A.S.O. at No. 18 Group, and for a year was in command at Gibraltar.

In the first World War Air Marshal Stevens had the unique experience of being captured by a submarine. He suffered engine trouble in a seaplane, force-landed and, after drifting for nine hours, was picked up by a U-boat which surfaced nearby.

Inter-tropical Front Investigated

A SMALL R.A.F. unit, No. 1301 Meteorological Flight, operating from Negombo, Ceylon, has just completed a three-year programme of investigation concerning flying conditions in monsoons and tropical weather generally.

Whereas it is ordinary practice to avoid thunder-cloud flying in the tropics, the pilots of this met. flight have made a point of never deviating from course, however severe the weather conditions, and have gained much valuable experience. The worst conditions of all were found during the transitional period, in October and November, between the north-east and south-west monsoons, when cloud-tops were estimated to reach to 40,000ft or more. At times the rainfall was so heavy that it was impossible to see the engine cowlings from the cockpits of the Bristol Brigands used for the work. Severe damage was done to the wire mesh of the engine de-icers and the airscrews often suffered considerably.

The main object of the flight investigation was to examine the behaviour of the phenomenon known as the inter-tropical front, the area of demarcation (as explained in an article in *Flight* a fortnight ago) between the air masses generally associated with the northern and southern hemispheres, and often viewed by aircrews with anxiety. A great deal of valuable information of air masses and actual weather was accumulated by the flight and it was generally found that, while excellent flying conditions lasted for much of the time, large build-ups of heavy clouds often occurred without warning. The inter-tropical front could be violently active one day and on the following give no sign of existence.

Lloyd's Cup and Trophy

THE Lloyd's Cup for rifle shooting, presented to the R.A.F. Regiment in 1943, was won last year by No. 1 (Armoured Car) Squadron, now serving with 2nd T.A.F. It was presented to the squadron by Air Marshal Sir Robert M. Foster at a ceremonial parade at Wunsdorf. Runners-up were No. 3 (Armoured Car) Squadron, and No. 18 (L.A.A.) Squadron was placed third.

For the third year in succession Lloyd's Trophy for A.A. gunnery, presented for competition among the L.A.A. units of the R.Aux.A.F. Regt., has been won by No. 2502 (Ulster) Squadron. Second place was secured by No. 2602 (City of Glasgow) Squadron, and No. 2603 (City of Edinburgh) Squadron came third.

R.C.A.F. European Appointment

IT has been announced by R.C.A.F. H.Q. in Ottawa that G/C. K. Hodson, O.B.E., D.F.C., is to have charge of the arrangements for the R.C.A.F. Air Division to be located on the Continent. He

BRISTOL 171s FOR COASTAL: The first Bristol Sycamore helicopter for Coastal Command left Filton for evaluation trials at St. Mawgan, Cornwall, on February 19th. It was piloted by F/L. J. G. Minifie, who, with F/O. J. I. Williamson and F/O. B. Walters, had previously had instruction from Bristol's helicopter test pilot, C. T. D. Hosegood (seen on the left, saying goodbye to F/L. Minifie).

SERVICE AVIATION . . .

will be stationed at the Canadian Embassy in Paris and will assist the Canadian ambassador in negotiating for the necessary air bases. He will also arrange with the U.S.A.F. for maintenance and supply services for the F-86's with which the squadrons will be equipped.

Retirement

A SUPPLEMENT to the *London Gazette* of February 22nd announced the retirement of Air Marshal Sir Aubrey B. Ellwood, K.C.B., D.S.C. For the past two years he has been A.O.C.-in-C. Transport Command.

R.Aux.A.F. Call-up Ends

IN the House of Commons, on February 20th, the Under Secretary of State for Air, Mr. Nigel Birch, stated that the special three months' training, for which the R.Aux.A.F. fighter squadrons were called up last year, would not be repeated. He said this decision applied not only to those called up last time but also to all those who had joined since, or would do so in the future.

R.A.A.F. Training Schedule

EACH month of 1952, until November, the Royal Australian Air Force will carry out some form of specialized exercise. These will vary from "Operation Panting Ants," in which No. 6 Squadron's Lincolns will perform a mobility exercise from Amberley to Darwin, to Operation "Bobbing Cork" in August when Lincolns and Dakotas will be engaged on anti-submarine and air/sea rescue patrols.

The biggest exercise of the year is Operation "Tom Thumb," to be held in November. Both the R.A.A.F. and the Citizen Air Force will be engaged in this operation, in which Newcastle will be attacked and defended.

Fighter Command's New Group

A NEW Group, No. 81, has been formed to direct training activities of Fighter Command. It will be responsible for the fighter Operational Conversion Units, the training of Control and Reporting system staff and for some other training activities formerly controlled by the operational groups of the Command. R.Aux.A.F. units will remain under their operational groups.

In command of the new group will be A. Cdre. L. W. C. Bower, D.S.O., D.F.C., who was formerly Group Captain Air Plans at Fighter Command H.Q.

The new A.O.C. has had wide and varied experience in the R.A.F. After leaving Cranwell he served in a torpedo bomber squadron, became a C.F.S. instructor, joined No. 202 Flying Boat Squadron and in the early years of the war commanded No. 217 Squadron, Coastal Command. From the end of 1943 until the cessation of hostilities in Europe he commanded No. 138 Wing (Mosquitoes) of No. 2 Group, 2nd T.A.F.

W/C. I. S. Smith, D.F.C., who until recently was Wing Commander Flying at Wattisham, is now Station Commander at Church Fenton.

BIGGIN HILL CONTROL: Mixed Regular and R.Aux.A.F. staff in the control tower at Biggin Hill. Left to right, S/L. G. Cherrington (R), F/L. J. W. Wiltshire (A), W/C. Pitt-Brown (Station Commander), F/O. P. D. Wood (R), F/O. D. Killpartrick (A), and F/O. L. D. Littleton (A).

Standardization Appointment

THE appointment has been announced of A. Cdre. G. W. Hayes, O.B.E., to take the position previously held by A. Cdre. F. J. St. G. Braithwaite on the Western Union Military Standardization Air Board. Until recently A.Cdre. Hayes was S.A.S.O. at Air H.Q. Iraq. A. Cdre. Braithwaite is now Director of Plans at the Air Ministry.

New Age Limits for Volunteers

MEN up to the age of 55 years can now volunteer for service in some of the ground branches and trades of the R.Aux.A.F. and R.A.F.V.R., if they have had previous service, and up to the age of 50 without previous service. This follows a decision to raise upper age limits in most ground branches and trades of the R.Aux.A.F. and R.A.F.V.R. and bring them in line with each other. As a result of this decision officers and airmen can now serve in ground branches and trades of the R.Aux.A.F. until the age of 60.

In the following ground branches and trades of the R.Aux.A.F. and R.A.F.V.R. —Air Traffic Control, Medical, Physical Fitness, Equipment, Secretarial and Technical—the upper age limit for officers and airmen is now 55 years for those with previous service and 50 for those without. For officers and airmen of the Fighter Control branch and the Radar Operating trade group, the upper age limit with previous experience is now 50 years and 40 years without. For entry into the Regiment and Marine branches and trades the upper age limit for candidates for commissions is now 35 and 38 years respectively and 40 and 38 years for airmen.

Women up to the age of 50 years can now volunteer for the W.R.Aux.A.F. and the W.R.A.F.V.R., provided they have some previous service and up to the age of 45 without previous service.

The age limits normally applied for aircrew remain unchanged. They are 18 to 30 years for the R.Aux.A.F. and 18 to 38 (30 for pilots) in the R.A.F.V.R.

Middlesex Auxiliaries Thanked

THE commanding officer, S/L. A. Deytrikh, and a detachment of officers and airmen from No. 604 Squadron, R.Aux.A.F., were invited to be present at the Middlesex Guildhall on Wednesday last to receive the public thanks of the Middlesex County Council for the spirit with which all ranks responded to the three months' call-up last year. In giving the thanks of the County Council, Ald. W. J. Grimshaw, J.P., also congratulated the squadron on the high standard of efficiency attained, which had earned commendation from Air Marshal Sir Basil Embry, A.O.C-in-C. Fighter Command.

Painting for Benevolent Fund

AN oil painting, "Air Raid on Convoy," by the late Julius Olsson R.A., has been presented to the R.A.F Benevolent Fund by the artist's widow, Mrs. E. M. Olsson.

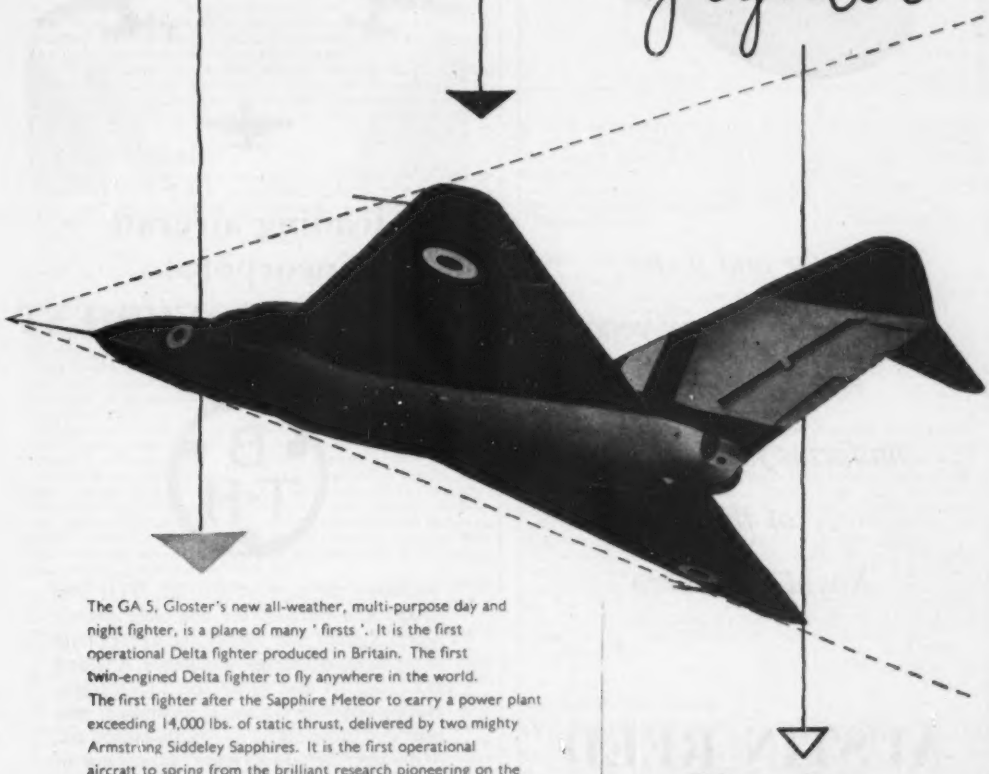
The canvas (33in x 26in), which was painted during the Battle of Britain and shown at the Royal Academy in 1941, will be on show at Tooth's Cork Street, London, gallery. Reserve price is 150 guineas.

Reunions

THE sixth annual reunion dinner of No. 3 G.T.S., R.A.F. and W.A.A.F., will be held at "The Victoria," Buckingham Palace Road, London, at 6 p.m. on March 15th. Details may be obtained from Joan Sherman, 121 Ashfield Road, Southgate, N.14.

The Albert Tavern, 52, Victoria Street, London, S.W.1, is the venue where all ranks of No. 78 Squadron will foregather on May 10th. Mr. F. Ivers, 23, Carnaby Street, London, S.W.1, is the organizer.

First Delta Fighter



The GA 5, Gloster's new all-weather, multi-purpose day and night fighter, is a plane of many 'firsts'. It is the first operational Delta fighter produced in Britain. The first twin-engined Delta fighter to fly anywhere in the world. The first fighter after the Sapphire Meteor to carry a power plant exceeding 14,000 lbs. of static thrust, delivered by two mighty Armstrong Siddeley Sapphires. It is the first operational aircraft to spring from the brilliant research pioneering on the Delta plan-form undertaken by the Hawker Siddeley Group. Such leadership is not surprising, however, when you remember that Gloster also gave the world its first successful turbo-jet aircraft, the historic Whittle E.28/39 and the first jet plane to go into squadron service, the Meteor Mark I in 1944. Being 'first' is a Gloster tradition.

Gloster GA/5

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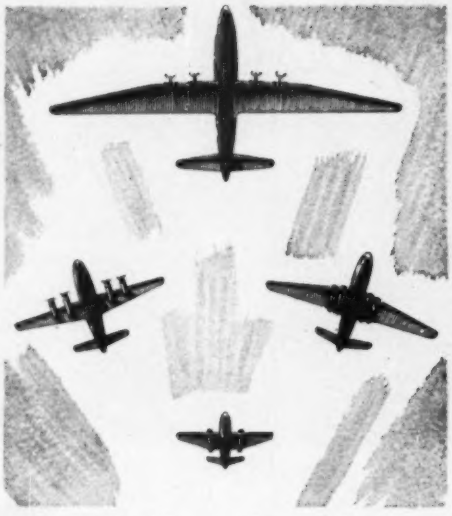

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CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Altimeter Position-error

IN your report of Mr. Stallibrass's lecture on air-traffic control, there is a statement that errors of some hundreds of feet have been observed by pilots descending below their new altitude in a vertical holding pattern before levelling out. Could this not be explained by the altimeter position-error changing? The position-error will vary with the air speed of the aircraft and normally the speed will increase during the descent to the new altitude. The aircraft will, of course, be flying on a new pressure datum and not on a true altitude, hence the error until the speed has again been reduced.

If my memory serves me correctly the Hawker Tempest had a big position-error in spite of having a static vent on the side of the fuselage. The effect of this was that if the aircraft was dived to 500 m.p.h. A.S.I. and levelled out at an altimeter reading of 1,000 ft the true height above the ground was only 400 ft, i.e., an indicated error of 600 ft. Yet at an indicated air-speed of about 150 m.p.h. the altimeter error was negligible.

The implications of various types of aircraft flying the airways on altimeter readings when these readings are themselves dependent on their respective position-errors are considerable.

Kingswood, Surrey. D. R. ROBERTSON.

That Cheap Aircraft

IN replying to the further thoughts on "Simplicity for Cheapness" voiced by F.W.V. and E.B.C. in *Flight* of February 8th (page 159), I would first like to thank both contributors for their considered opinions.

I feel, however, that they have largely missed the main point behind the original article, which was that, if a simple light aircraft could be mass-produced, the price would automatically ensure that a rewarding number was sold. The argument of F.W.V. and E.B.C. would appear to be "the market is too small to permit mass-production methods, so let us continue to make light aircraft by hand." As to the number of potential buyers in this country, I would say it is indeterminate, since there has not yet been anything within the reach of the majority—in any case, it is probable that 90 per cent of the total production would be sold abroad. This last point is important, since it underlines the choice of an all-metal structure.

Mention of current car prices does not help the argument, partly due to their present artificially high level, and partly because the aircraft I advocated was a very much simpler vehicle than any mass-produced car. Granted, cars are produced in tens of thousands—as this aircraft could be—but what about production costs? Consider the machining required to make even a simple car gearbox, transmission and back axle. Our aircraft structure makes no parallel demand; in fact, the essence of the study was that fine-limit finishing was *eliminated*—with the exception of the engine and, perhaps, control-surface hinges.

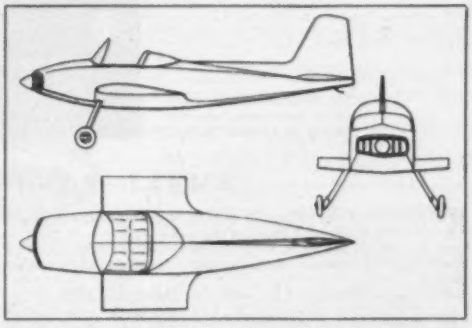
Regarding the power plant, why should a petrol-oil mixture imply "obvious disadvantages" to a private owner? I am certainly not advocating the use of such a fuel, but we must not forget the number of motor cyclists who are quite content with it. At least it enables the designer to produce a very much cheaper engine.

The wing in the original sketch certainly was too far aft. I still stick to the single spar, however, and am quite prepared to attach the undercarriage to the fuselage if the c.g. position so dictates. As to the single-leaf-spring legs, there is no necessity for them to be heavier than orthodox types; I think available evidence shows them to be rather lighter. If they are to be tapered, as I agree is desirable, recently introduced rolling methods could do this quite cheaply (in the U.S.A., tapered sheet is available from stock).

I did have 16 s.w.g. in mind for the airframe, with an option on 12 or 10 for the main wing panels. This is not inordinately heavy, will not easily suffer damage, and will not buckle under normal flight-loads, even when unsupported over a large area. I grant that the spar will do most of the work in transmitting wing lift to the fuselage; that's what its there for.

F.W.V. and E.B.C. have certainly touched a sore point when they mention the A.R.B. This authority has a most difficult task, and I would not ask for discrimination in favour of light aircraft from this quarter; in fact, I don't think the private owner would expect it. Finally, I am not quite clear upon the relaxed structural stiffness hoped for; I hardly expect the ultra-light conception to worry much about gust requirements, but I fail to see why such a design should be permitted more, or less, incidence of flutter than a more complex aircraft.

Pinner, Middlesex. W.T.G.



I WAS much interested in your article, "Simplicity for Cheapness." May I suggest the following alternative for the fuselage—slab sides of framed plywood with central keel and decked top and bottom as shown in the accompanying diagram?

The engine for a cheap light aircraft is very difficult, but this type of fuselage would take a flat twin as suggested.

Reigate, Surrey. K. S. FREESON.

A 1910 Collision

IN connection with recent correspondence on the 1910 Milan meeting, it is interesting to note that subsequent to this accident, the trailing edge portion of the mainplanes was cut away on the Antoinette monoplane to give a better field of view to the pilot.

A browse through the latter part of *Flight*, vol. II, reveals that M. Thomas made a rapid recovery and was flying again soon after.

Southampton. FRANCIS G. BOREHAM.

International Navaids

IN his letter published in your issue of February 15th, Mr. W. Gregson, of Ferranti, Ltd., suggests that "an influential body of opinion in this country is lined up against the rest of the world" in support of Decca. To this body must be added, surely, another in France, actively preparing a Decca chain, and another in Germany where a chain is already on the air; in terms of relative traffic density, therefore, the "rest of the world" represents a less overpowering majority than the phrase might first suggest.

What is really surprising, however, is Mr. Gregson's assertion that the main factor delaying the introduction of V.O.R./D.M.E. is the international controversy now raging—implying, presumably, that from the technical and operational standpoints the combination of V.O.R. and D.M.E. is ready for development. To this one can only reply, with Beachcomber, "Oh, I say, look here!"

London, S.W.9. C. POWELL,
The Decca Navigator Co., Ltd.

The R.N.Z.A.F. Devons

WE were interested to read in your issue of February 15th the short reference to the de Havilland Devons for the R.N.Z.A.F. For the sake of complete accuracy, we should like to comment on the caption to the left-hand illustration, showing the aft-student navigator's table. In your short article you explain under (6) that the Gyrosyn Compass master indicator is on the forward table and that a standard repeater from the Gyrosyn Compass is on the aft table. The photograph reproduced does not show the master indicator but the repeater and, therefore, presumably illustrates the aft table. As you will see, the caption refers to it as the master indicator.

Incidentally, these aircraft are to be equipped with our light-weight gyropilot, type A.L.3, which is a development of the type A.L.1 and A.L.1A, utilizing the azimuth reference provided by the Gyrosyn compass instead of that provided by an air-driven directional gyro. I think some time ago you referred to the fitting of similar equipment in the Fokker S.13 crew-trainer. This is, in effect, the second crew or navigational trainer to be fitted with this automatic pilot. K. I. T. RICHARDSON,

Brentford, Middlesex. Sperry Gyroscope Co., Ltd.

THE INDUSTRY

The new administration block at the Bowthorpe-Hellerman factory at Crawley, Sussex.

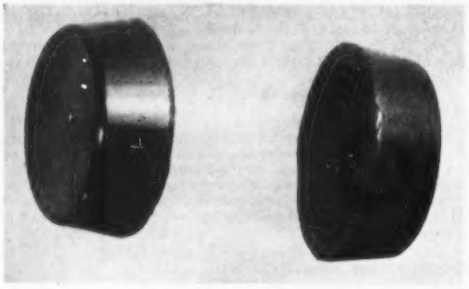
SMALL PARTS in a BIG WAY

RECORDING the successful growth of a comparatively young company is always a pleasant task; this we felt to be particularly true when, last week, we attended the official opening of the Bowthorpe-Hellermann administration building at Crawley, Sussex.

Bowthorpe Holdings, Ltd., embraces Bowthorpe Electric Co., Ltd.; Bowthorpe Engineering Co., Ltd., and Hellermann Electric Ltd. While the two first-named are chiefly concerned with the manufacture of overhead electric-cable fittings and moulds for plastic products, Hellermann Electric are the manufacturers of innumerable small items for the aircraft industry and other manufacturers; in particular, they claim to be the largest single suppliers of cable sleeves and flag markers. The Twinlay cable marker—a printed P.V.C. sleeve protected by a transparent plastic film—is proving especially popular.

Helvin, a special form of P.V.C., is also being used to make a wide range of articles—cable grummets, flexible reflectors, etc.—by injection moulding, low-pressure moulding, dipping and spraying. This material is resistant to most airborne fluids and can be supplied for use at various temperatures from —40 to 100 deg C.

The new building, which houses the Bowthorpe-Hellermann administrative staff, was formally opened last week by Mr. W. Puckey, Deputy Controller of Supplies, (Air), M.o.S.; in performing the ceremony, Mr. Puckey stated that nearly every British aircraft counted items of the company's manufacture among its equipment. The company was founded in 1937 "in a small backyard," as Mr. Puckey put it, since which time it has grown "faster than the P.1067." The entire establishment at Crawley—adjacent to Gatwick Airport—is characterized by a combination of cleanliness and completeness of equipment rarely found this side of the Atlantic.



The plastic glands of a Hellerman pressure-sealing cable bung. The cables are gripped in the holes, and extra cables can be inserted by punching-through holes already partly formed; the gland thus remains airtight no matter whether the full number of cables is fitted or not.

Storing Petroleum

"Storage of Petroleum Spirit," by H. E. Watts, M.B.E., G.M., B.Sc., Ph.D., F.R.I.C. Charles Griffin and Co., Ltd., 42, Drury Lane, London, W.C.2. Price 28s.

THOUGH primarily intended for the guidance of local authorities, this very comprehensive work on the legal and practical aspects of petroleum-spirit storage will unquestionably be of value to any firm (such as one concerned with aircraft manufacture and operation) whose work involves the use of petroleum spirit. The book is the first of three by the same author, who is H.M. Chief Inspector of Explosives; the remaining two are to deal, respectively, with *Storage of Petroleum Mixtures, Calcium Carbide and Acetylene* and *Storage of Explosives.*

Mobile Lifting

This new "Staffa" 2½-ton mobile crane should be particularly useful for airfield and factory duties. Power for travelling and hoisting is provided by a 15 b.h.p. Newage-Austin four-cylinder petrol engine, and the jib is luffed hydraulically. Chamberlain Industries, Ltd., Staffa Road, London E.10, are the makers.

Mr. George Thornton-Norris

Well known to many customers of the aircraft division of the Lockheed Hydraulic Brake Co., where he was a sales engineer for ten years, Mr. George Thornton-Norris died suddenly on Thursday, February 14th., at the early age of 55. Mr. Thornton-Norris, who served as an R.F.C. pilot in the First World War, leaves a widow and an eight-year-old son.

Test-chamber Fire-protection

FROM the Pyrene Co., Ltd., come details of the special fire-protection equipment supplied by them for the big high-altitude test-chamber at the Weybridge works of Vickers-Armstrongs, Ltd. A concentration of 5,600 lb of CO_2 gas is required to protect the chamber and the methanol cellar immediately below. To achieve this a battery of seventy 80-lb cylinders has been provided, which, in conjunction with a suitable distribution system, discharges gas into both these sections simultaneously in the event of fire in either section.

The installation is operated by manual pull-handles from the control room at first-floor level or from the cylinder position at ground level.

A switch interlocked with the CO_2 discharge mechanism ensures that the chamber extractor fan and pump motors are automatically shut down if the fire system is operated.

Co_2, incidentally, is non-toxic to personnel, and non-injurious to delicate mechanisms.

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Trade Advertisers who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

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The Publishers retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

All vacancies advertised are, where applicable, subject to The Notification of Vacancies Order, 1952, with particular reference to Article 3 thereof.

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SPECIAL OFFER—D. H. Dove, 300 hours since new, 18 months C. of A. Full particulars on application.

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DAKOTAS
CONVERTED
MILITARY TO CIVIL
FREIGHTER—PASSENGER.
QUICK DELIVERY
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We operate engine exchange schemes to most parts of the world.

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A wide range of aircraft and engine spares in stock and a competent staff to assist in the location of spares in short supply.
Let us know your requirements.

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Cables: FIELDAIR, Croydon. [0268

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OF EVERY DESCRIPTION

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IN ANY PART OF THE WORLD

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TIGER MOTH. Engine hours, 408. Airframe, 4,738. Without C. of A. £250.
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CHRISLEA Super Ace. Perfect condition. Airframe and engine 125 hours. Price £950.—Owner, 51, Sidbury, Worcester. [7697
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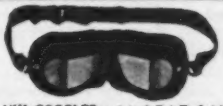

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NO. U.K.'s largest caravan selection (all guaranteed unconditionally for year with free-van-loaned-for-leaky-one and all repairs free) certainly isn't the dearest! And for many customers it isn't the nearest. But there are more and cheaper vans to see, small delivery charges, a better guarantee, and the help of the fine Caravan Residents' Association to get and keep you a site. Good H.P. terms and part-exchanges too. So why not write for 1 lb. of brochures and free advice on caravans to Tiplow only please.—A. S. Jenkinson, Ltd. (our larger selection in winter time—London Branch), 89, Oxford Street, London, W.1 (Corner Rathbone Place). Tel.: Langham 2876-7. Two minutes from Tottenham Court Road Tube Station. Open till 8 p.m. seven days a week. Also at Bath Road, Taplow, Bucks. Tel.: Maidenhead 3494/5/6. Always open. Easy to reach—right on Main A4. Outskirts Maidenhead. Taplow Station 4 mins. And opening March 3rd. Hammersmith Branch, corner of Sussex Place and Hammersmith Bridge Road, S.W.6. One minute Hammersmith Broadway. [0240

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FLYING partner required for small Manchester charter company.—Box 7222. [7707

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FIRE protection by modern methods. Write for booklet. F.R.F.A.E. to National Fire Protection Co., Ltd., Essex Works, Faggs Rd., Feltham, Middx. Tel.: Fel. 4081. [0660

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TIME RECORDERS

TIME recorders service rental. Tel.: Hop. 2239.—Time Recorder Supply and Maintenance Co., Ltd., 157-159, Borough High Street, S.E.1. [7303

STAFF item checking and job-casting time recorders (all makes) for quick cash sale; exceptional condition.—Box 7241. [0040

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THE COLLEGE OF AERONAUTICS

A COURSE of lectures on Stability and Control of Aircraft at Subsonic Speeds will be given at the college from Monday, April 21st, to Friday, April 25th, 1952. This is a repetition of the course given in October, 1951. The course will deal with the practical and theoretical aspects of the stability and control characteristics of aircraft flying at subsonic speeds, emphasis being divided between the estimation and flight testing of stability and control characteristics. The subject will be treated from first principles and is intended primarily for those with limited experience of stability and control problems. Fees for the course are: Tuition fee, £10/10/-; residence charge (including full board), £5/15/-. Copies of the syllabus and forms of registration can be obtained from the Registrar, the College of Aeronautics, Cranfield, Bletchley, Bucks. [7704

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FREE! Brochure giving details of courses in all branches of aero eng. covering A.F.R.Ae.S., M.C.A., exams., etc. We are the only postal training college operated by an industrial organisation.—Write to E.M.I. Institutes, Postal Division, Dept. F26, 43 Grove Park Road, London, W.4. Tel.: Chiswick 4417. (Associated with H.M.V.) [0226

SOUTHEND-ON-SEA MUNICIPAL FLYING SCHOOL, Eastwood. Tel.: Rochford 36204. Comprehensive training for private, commercial licences and instructors' endorsements. M.C.A. approved for 30-hour course. Auster aircraft fitted with radio. Hourly rates: Solo, day £3, night £4; dual 5/- extra; contract rate £2/10/-. Link trainer 10/-. No fees or subscriptions. Please write for further details. [0332

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Another outstanding offer from the Radio Radar Department!

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The first of these types is the

GEE EQUIPMENT

These installations are complete and the units utilised therein are as follows:—

1 off Receiver R.1355.
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1 off each R.F. Unit type 24, 25, 26 and 27.
1 off Aerial Loading Unit, Whip Aerial and Base
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1 off Voltage Control Panel type 9.
1 off Complete set of Harness constructed to your own requirements.

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These installations, once again, are complete and the units utilised therein are as follows:—

1 off Transmitter/Receiver TR.3173.C.
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2 off Receiver Aerial Systems type 184.
1 off Voltage Control Panel type 9.
1 off Rotary Convertor Unit type 2.
1 off Switch Unit type 78.A.
1 off Beam Approach Aerial type 312.
1 off Complete set of Harness constructed to your own requirements.

Both installations are, of course, designed for use in the larger type Aircraft, and are thus restricted to use from a 24-volt supply.

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"The Aeroradiologue," our latest and most comprehensive catalogue of aircraft Radio equipment available from our organisation, is now ready for distribution. We suggest that an immediate request be made for one of these catalogues should one not already be included in your technical library.

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BLACKBURN AND GENERAL AIRCRAFT, LTD., have vacancies for the following personnel on an expanding programme of work of national importance:—
STRESSMEN, senior and intermediate, with sound qualifications and aircraft experience.
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LOFTSMEN and LOFTSWOMEN, with experience of aircraft full-scale layout work.
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The Personnel Superintendent,
BROUGH, YORKS. [7713

STRESSMEN (Junior and Senior),
also
WEIGHTS ENGINEERS
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SHORT BROTHERS AND HARLAND, LTD.
Applications, stating age, experience and qualifications, to:—
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SHORT BROTHERS AND HARLAND, LTD.,
QUEEN'S ISLAND, BELFAST. [7679

DRAUGHTSMEN
SENIOR, INTERMEDIATE AND JUNIOR (OVER 22)
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SHORT BROS. AND HARLAND, LTD.
IN THEIR AIRCRAFT DRAWING OFFICE,
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(preferably with aircraft experience).
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CHIEF DRAUGHTSMAN,
SHORT BROS. AND HARLAND, LTD.
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VICKERS-ARMSTRONGS, Ltd. (Aircraft Section), have vacancies for the following staff:—
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JIG AND TOOL DRAUGHTSMEN
(aircraft experience preferable, but not essential).
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WIND tunnel technicians of degree standard or with H.N.C. in aero subjects. Previous experience preferred.
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TECHNICAL illustrators with previous experience in aircraft work.—Write, stating age, qualifications and details of experience, to: Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.2. [7760
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SENIOR draughtsmen required; some knowledge of aircraft. Permanent. South Coast.—Write, stating qualifications and salary, to Box 7158. [7748

AIRCRAFT DESIGN TECHNICAL OFFICE requires the following personnel for work on an interesting range of civil and military aircraft and helicopters:—

JUNIOR and intermediate technicians for aircraft structural analysis. Engineering degree or Higher National Certificate, preferably with aircraft stressing experience.

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JUNIOR and intermediate weights assistants, with National or Higher National Certificate in Engineering and some experience in an aircraft weights section of drawing office.

PROGRESSIVE appointments with good opportunities for advancement on merit.

EXCELLENT working conditions, welfare and sports facilities. Opportunity exists to join subsidised private flying club.

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THE Chief Draughtsman, Alan Muntz and Co., Ltd., (Aircraft Section), Beeston Airport, Bounslow, Middlesex. [0650

CHIEF pilot required shortly for European passenger service. Commercial licence and 2,000 hrs. necessary.—Write to W. S. Shackleton, Ltd. 175 Piccadilly, London W.1. [0072

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TYPIST with experience of aircraft despatch and handling procedure required for Southend. Good salary.—Apply, in writing, to Personnel Manager, Crewair, Ltd., 11 Bruton St., London, W.1. [7738

WANTED, research engineer. Keen man required. Interesting work, plenty of scope. Knowledge of rubber. Permanent. South Coast.—Write, stating qualifications and salary, to Box 7157. [7745

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LICENSED radio engineer and radio mechanics at our base at Stansted Airport, Essex.—Apply by letter or telephone, to the Senior Radio Engineer, Aviation Traders Ltd., Southend Airport, Essex. Tel.: Rochford 56401. [0050

INSTRUMENT inspector, specialist in flight instruments and A.D. auto pilots and preferably A.R.B. licensed—is required by Fields at Bovingdon. Applications to Personnel Officer, Field Aircraft Services, Ltd., Croydon Airport, Surrey. [7694

SENIOR inspector required for small A.I.D. approved machine shop working on experimental contracts. Ideal working conditions. Good pay. Permanency for right man. Situated on South Coast. [7771, Flight Library, Lymington. [7756

WEIGHT estimator required by Percival Aircraft, Ltd., Luton Airport, Beds., for work on fixed wing and helicopter aircraft.—Apply, giving details of age, qualifications, experience and salary required to: Manager, Ministry of Labour and National Service, Luton, Beds. [0592

OVERSEAS appointments—Pilots. The vacancies exist in Sudan Airways for pilots based in Khartoum. The period of contract is for 3 years and subject to 3 months notice on either side after completing the first year of service.

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APPLICATIONS should be made in writing to Air Crew Superintendent, Airwork Limited, Blackbushe Airport, Camberley, Surrey. [7760

JUNIOR radio engineer with current M.C.A. Air Licence required for aircraft installation, testing and flight duties.—Write, stating experience, qualifications, age and salary required, to the Personnel Manager, The De Havilland Aircraft Co., Ltd., Christchurch, Hants. [7760

JIG and tool draughtsmen, senior and junior, required. Permanent positions on interesting class of work.—Apply, stating age, experience and salary required, to Personnel Manager, Boulton Paul Aircraft, Ltd., Pendeford, Wolverhampton. [7710

GLOSTER AIRCRAFT Co., Ltd., have vacancies for fully experienced aircraft structural and electrical draughtsmen.—Applications, in writing, stating age, experience and salary required, must be made through an Employment Exchange or Scheduled Agency. [0910

DESIGNER-DRAUGHTSMAN for aircraft installation and commercial projects. Applicant should have sound engineering background. Experience in the fabrication of light-alloy components for both prototype and production an advantage.—Write, giving details of age and experience, to Chief Draughtsman, Delaney Gallay, Ltd., Edgware Road, Cricklewood, N.W.2. [7687

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JUNIOR draughtsman required, S.E. London area, with experience of design and development of aircraft instrument mechanisms.—Applicants should write, stating age, salary expected, with details of experience, to Box F.948 at 191, Gresham House, E.C.2. [7694

SENIOR designer draughtsman required, S.E. London area, with experience of design and development of aircraft instrument mechanism.—Applicants should write, stating age and salary expected, with details of experience, to Box F.946 at 191, Gresham House, E.C.2. [7695

CREWAIR, Ltd., require first-class, fully qualified flight engineers for Viking operations. Permanent contracts available with highest pay and attractive conditions.—Apply, in writing, giving full details to Personnel Manager, Crewair, Ltd., 11, Bruton Street, London, W.1. [7737

TECHNICAL authors and illustrators required by Percival Aircraft Ltd., Luton Airport, Beds. Knowledge of M.o.S. procedure desirable.—Applications, in writing, stating age, experience and salary required to Manager, Ministry of Labour and National Service, Luton, Beds. [0594

GLOSTER AIRCRAFT Co., Ltd., require senior and junior weight engineers. Interesting work on new projects. Permanent positions offered to suitable applicants. Applications in writing, stating age, experience, qualifications and salary required, must be made through an Employment Exchange or Scheduled Agency. [0013

LETHBRIDGE FLYING CLUB, Alberta, require a flying instructor, preferably single and with previous Canadian experience. Average earnings should exceed 300 dollars monthly.—Write, giving full details of experience and two references, to: Lethbridge Flying Club, Alberta, Sask., Canada. [7750

EXPERIENCED drawing office checker required to check detail drawings and general arrangement drawings of aircraft hydraulic components and undercarriages, etc.—Write, stating age, experience and salary required, to Mr. R. J. Brown, Chief Draughtsman, British Messier, Ltd., Cheltenham Road East, Gloucester. [7756

LANCASHIRE AIRCRAFT CORPORATION have vacancies for aircraft captains, pilots with commercial licence, instrument rating, navigators, radio officers. Salaries in accordance with qualifications and experience. —Applications to Personnel Manager, Bovingdon Airport, near Hemel Hempstead, Hertfordshire. [7751

VACANCIES for draughtsmen and stressmen exist in the Saunders-Roe Helicopter Division at Eastleigh, near Southampton.—Interested persons should apply, stating age, experience, salary required, to Mr. Cox, to the Personnel Office, Saunders-Roe, Ltd., East Cowes, Isle of Wight. [7690

H. M. ROBINSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [0420

SENIOR designer for aero-engine gas turbine project design required in well-known firm in London area. Previous experience on mechanical design is essential. Good prospects of promotion for a suitably experienced and enterprising candidate.—Please write, giving full details of age, experience, qualifications and salary required, quoting Ref. A.3C, to Box 6852. [7744

DEVELOPMENT engineers (two), with experience in the design and testing of radial compressors and gas turbines, required for development work on a project of unusual interest. Salary in accordance with experience.—Applications should be sent in writing to the Chief Research Engineer, C. Parsons and Co., Ltd., Heaton Works, Newcastle-upon-Tyne, 6. [7712

SENIOR wind tunnel technicians required, graduates with some experience in wind-tunnel work and with good aerodynamics background. Interesting project work and good prospects in well equipped and expanding department. Good salary, according to age and experience.—Apply: Employment Manager, Vickers-Armstrongs, Ltd., Weybridge, Surrey. [7719

RESEARCH engineer required for turbine laboratory. An experienced in precise measurement of gas flow and familiar with scientific experimental techniques. Successful candidate will operate plant and be responsible for care and accuracy of instrumentation.—Apply: Personnel Officer, Sir Geo. Godfrey and Partners, Ltd., Hanworth Road, Hanworth, Middlesex. [7749

DRAUGHTSMEN are required by a well-known engineering company for employment in the London area. There are vacancies for men to work on aero engine detailing and design, test plant design and gas turbine blade design. These are permanent pensionable positions carrying good salaries and prospects.—Applications quoting AEE, to Box 6889. [7642

AIR FORCE, Naval, civil and helicopter aircraft all in operation at Percival Aircraft, Ltd., Luton Airport, Beds. Applications are invited from senior and junior draughtsmen, and stressmen for work on this interesting programme.—Write, giving details of experience and salary required, to Manager, Ministry of Labour and National Service, Luton, Beds. [0595

THE GLOSTER AIRCRAFT Co., requires senior and intermediate stressmen to work on designs and projects of advanced interest. Excellent prospects of advancement for sound and energetic men.—Applications i.) writing, giving full particulars of technical qualifications, age, experience and salary required, must be made through an Employment Exchange or Scheduled Agency. [0011

JIG and tool draughtsman (age 25-35) required by manufacturers of automobile and aircraft accessories in South Midlands. Practical experience in toolroom and production shops, and good technical qualifications essential. Salary according to ability. Single accommodation available. State salary, age and full particulars.—Box 7162. [7761

APPLICATIONS are invited from senior and intermediate design draughtsmen, experience of aero engine design desirable, but not essential, for vacancies. —Please write, stating age and giving details of previous experience in chronological order to the Personnel Officer, The de Havilland Engine Co., Ltd., Star Lane, Edgware, Middlesex. [7699

EXPERIENCED stressman required by Percival Aircraft, Ltd., Luton Airport, Beds., for responsible position in stress office. Minimum requirements H.N.C. (or equivalent), several years' experience, ability to take charge of stressing of complete aircraft.—Applications, in writing, to Manager, Ministry of Labour and National Service, Luton, Beds., giving details of training, experience, age and salary required. [0596

SERVICE engineer required having good knowledge of reciprocating aircraft engines and reasonable knowledge of electronic practice. Preference will be given to applicants with experience of electronic engine performance analysis. Successful applicant will be required to travel in U.K. and Continent. Salary commensurate with qualifications and experience, but not less than £450 p.a. Superannuation scheme.—Apply, with full details of age, experience and salary required, to the Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middlesex. [7690

SITUATIONS VACANT

APPLICATIONS are invited from design draughtsmen and stressmen, also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.—Applications should state full particulars of experience and qualifications and should be addressed to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middx. [5931]

ROCKET motor design and development. Mechanical engineers, physicists, chemists, mechanical and civil draughtsmen are required for work in this new and rapidly expanding field, on a project connected with guided missile programme. Location in West Midlands. Mechanical engineering applicants should have a 1st or 2nd class honours degree.—Applications to Staff Officer, Box 7221. [7769]

DESIGNER draughtsmen required by Lockheed Hydraulic Brake Co., Ltd., Leamington Spa. Should be fully experienced in light mechanical engineering. Knowledge of hydraulics an advantage. Opportunity for early promotion to section leader grade on proof of ability. Single hostel accommodation available.—Write to Personnel Officer, giving full particulars of salary, age and experience. [7762]

HANDLEY PAGE, Ltd., have a vacancy for a technical assistant with a good mechanical engineering background, who will be required to carry out work in connection with thermo-dynamic problems for aircraft air conditioning and thermal de-icing systems.—Write, stating age and giving particulars of qualifications and experience, to Staff Officer, Handley Page, Ltd., Claremont Rd., London, N.W.2. [7760]

TECHNICAL assistants, both junior and senior, required in mechanical engineering department for work of national importance in connection with development of gas turbine engines. Excellent prospects exist in sections dealing with rig test of engine components, vibration static structure test and research in gears and bearings. Qualifications: degree or H.N.C.—Apply: Reference No. V1, Armstrong Siddeley Motors, Ltd., Coventry. [5953]

TEST assistants, both junior and senior, are required for an interesting programme of structural testing. Juniors should hold Ordinary National Certificate and have preferably had some experience in this type of work. Seniors should have Higher National Certificate or its equivalent and a minimum of 2 years' experience in test work.—Apply, giving details of training and experience, to the Personnel Manager, Boulton Paul Aircraft, Ltd., Wolverhampton. [7684]

ARMSTRONG SIDDELEY MOTORS have a few vacancies for senior and junior stressmen to do work on strength investigations and calculations on gas turbine aero engines. Degree, Higher National Certificate or equivalent essential. This is work of prime national importance. There are also a few vacancies for senior and junior stressmen for work on the installation of gas turbines in aircraft.—Apply in some detail to Reference A.S.8.1. [5480]

INTERNATIONAL AERADIO, Ltd., offers careers to experienced air traffic control officers at overseas airports. Basic salary starting at £600 and rising to £900 p.a. plus adequate overseas allowances to cover local conditions, free air passages for staff and families. Single pilots and navigators will be considered. Local paid leave annually, and paid U.K. leave every 2/3 years. Pensions and insurance fund. Kit allowance.—Write: Personnel Officer, 91, Park Street, London, W.1. [7695]

THE GLOSTER AIRCRAFT Co. requires the services of a number of aerodynamicists (a) for design and project work, and (b) for flight test reduction. Opportunity exists for individuals to vary their experience within the Aerodynamics Department. Candidates with some years' experience preferred, but applications from juniors with sound mathematical ability will receive full consideration. —Applications in writing, giving full particulars of age, experience and salary required, must be made through an Employment Exchange or Scheduled Agency. [5913]

SITUATIONS VACANT

HANDLEY PAGE (Reading), Ltd., have the following vacancies in their design office:—A senior stressman is required; must have good experience and a degree or Higher National Certificate with endorsements in aeronautical subjects. Also required are senior and intermediate draughtsmen with aircraft experience. The positions are progressive and offer excellent opportunities for the right men. Please send full particulars to the Personnel Officer, Handley Page (Reading), Ltd., The Aerodrome, Woodley, Reading, Berks. [5971]

SENIOR scientific officers, scientific officers, patent examiner and patent officer classes. The Civil Service Commissioners invite applications for permanent appointments to be filled by competitive interview during 1952. Interviews will continue throughout the year, but a closing date for the receipt of applications earlier than December, 1952, may eventually be announced. Successful candidates may be appointed immediately. The scientific posts are in various Government Departments and cover a wide range of scientific research and development in most of the major fields of fundamental and applied science. The patent posts are in the Patent Office (Board of Trade), Admiralty and Ministry of Supply.

CANDIDATES must have obtained a university degree of with first or second-class honours in an appropriate scientific subject (including engineering) or in mathematics, or an equivalent qualification, or for scientific posts, possess high professional attainments. Candidates for senior scientific officer posts must in addition have had at least three years' post-graduate or other approved experience. Candidates for scientific officer and patent posts taking their degrees in 1952 may be admitted to compete before the result of their degree examination is known.

AGE limits: Senior scientific officers, at least 26 and under 31; for scientific officer and patent classes, at least 21 and under 26 during 1952 (or under 31 for permanent members of the experimental officer class competing as scientific officers). London salary scales: senior scientific officers (men) £812 10s.–£1,022 10s.; (women) £681 5s.–£917 10s.; scientific officers (men) £440–£707 10s., (women) £440–£578 5s.; patent examiner and patent officer classes (men) £440–£655, (rates for women under review). Somewhat lower rates in the provinces.

FURTHER particulars from the Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London W.1, quoting No. S. 53/52 for senior scientific officers and S. 52/52, S. 124/52 for the other posts. [7765]

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A/L, the above personnel, with the exception of the technical author, should preferably hold at least the Higher National Certificate in Engineering, but consideration will be given to other applicants with lower qualifications.—Applications for all posts should be made in writing, stating age, experience, qualifications, salary expected and details of the type of accommodation which would be required in the Leicester area. All applications to Chief Designer, Auster Aircraft, Ltd., Rearsby Aerodrome, Leicester. [7663]

BRITISH OVERSEAS AIRWAYS CORPORATION invite applications for the position of instrument flying instructor, to be stationed near London Airport. The duties include instrument flying instruction covering applied instrument flying on radio range, I.L.S. and A.D.F.; conversion of single-engine aircraft pilots to Consul/Dove aircraft; and staff pilot duties. Applicants must have Commercial Pilot's Licence, with current instrument rating, sound knowledge of I.L.S., radio range and A.D.F., with instruction experience, and instructor's endorsement or the ability to obtain this. Salary, £950–£1,150 p.a., according to experience and qualifications.—Applications in writing should be submitted to Chief Personnel Officer, B.O.A.C., Airways House, Great West Rd., Brentford, Middlesex. [7707]

ELECTRICAL engineers and physicists are invited by the Ministry of Supply to apply for the following post in the Scientific Officer class at the Instrument and Photographic department of the Royal Aircraft Establishment, Farnborough, Hants. For the analysis of the complex dynamical problems arising in automatic control of aircraft and for research upon methods of control. An interest in aerodynamics, particularly stability and control is desirable and candidates must be willing to fly as an observer. Some experience in research or development of light electrical or electronic equipment, or servo systems, and a knowledge of electronics would be advantageous. Candidates should have a first- or second-class Honours degree or equivalent qualification in physics or electrical engineering. Applicants for the senior grade must be at least 26 years of age and should have at least three years' post-graduate research experience. Salaries will be assessed according to age, qualifications and experience within the inclusive ranges. Senior Scientific Officer, £781–£960. Scientific Officer, £417–£675. Rates for women somewhat lower. The post is unestablished but carries benefits under F.S.S.U.—Application forms obtainable from Ministry of Labour and National Service, Technical and Scientific Register "K," Almack House, 26 King Street, London, S.W.1, quoting A348/51/A. [7753]

SITUATIONS WANTED

All Situations Wanted advertisements are, where applicable, subject to The Notification of Vacancies Order, 1952, with particular reference to Article 3 thereof.

EXPERIENCED parachutist-aircrobat req. job, flying-circus, advert., film or similar.—J. Johnson, 128, Bernard Street, Southampton. [7770]

R.C.P.O. air artificer, 30, seeks position civil aviation. Ex-Halton app., 12 yrs. exp. maintenance modern aircraft, pistons, jets. Instructional exp. Available Aug.—Box 7222. [7768]

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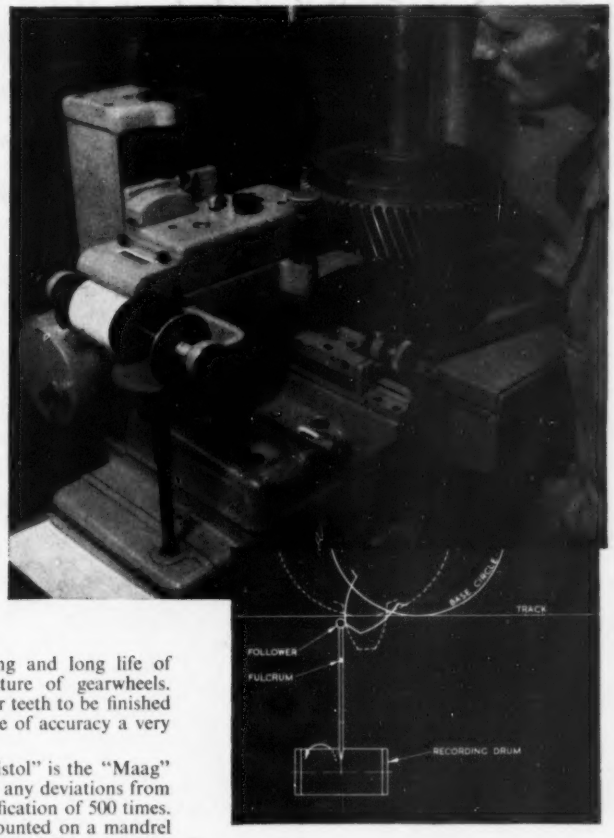

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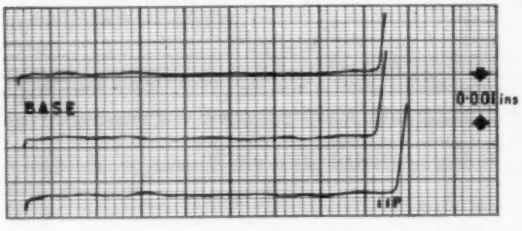

Typical chart produced by the testing machine.

The principle is shown diagrammatically above where it can be seen that the follower will only deflect if the tooth is not a pure involute.

A pen coupled to the follower records on a rotating drum the result of traversing the tooth flank, any movement of the follower being greatly magnified. A pure involute would produce a straight line on the chart. Sample traverses for three tooth flanks are shown on the left. Intentional deviation, such as tip relief, can also be measured from the chart.

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